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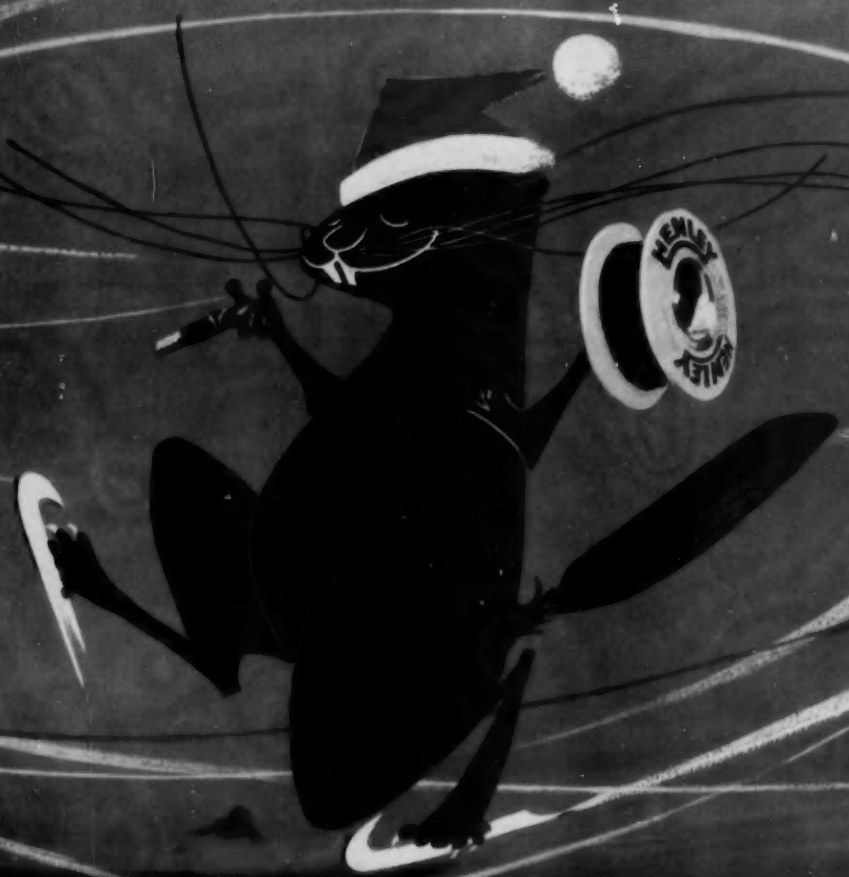

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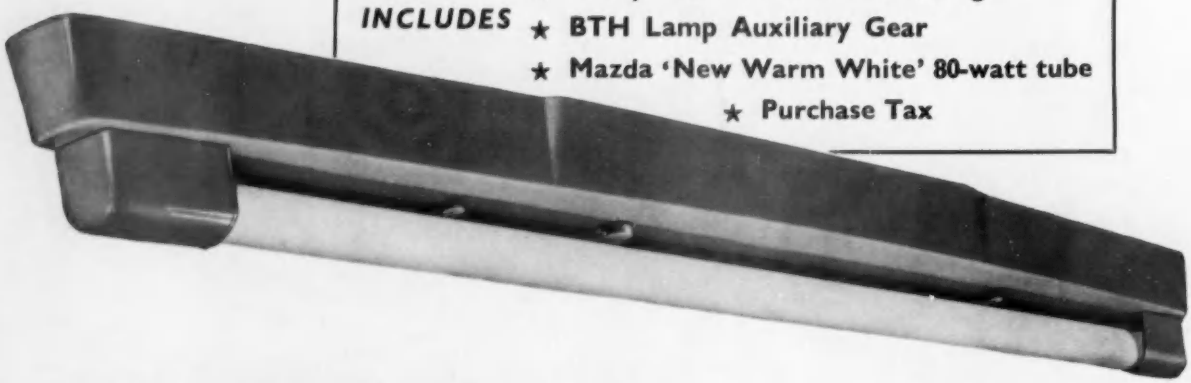

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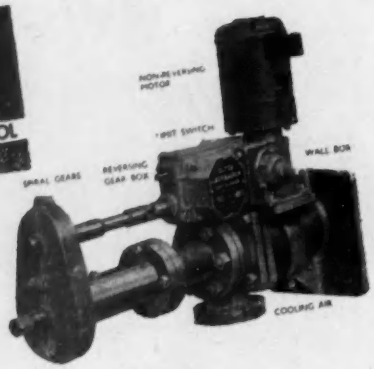

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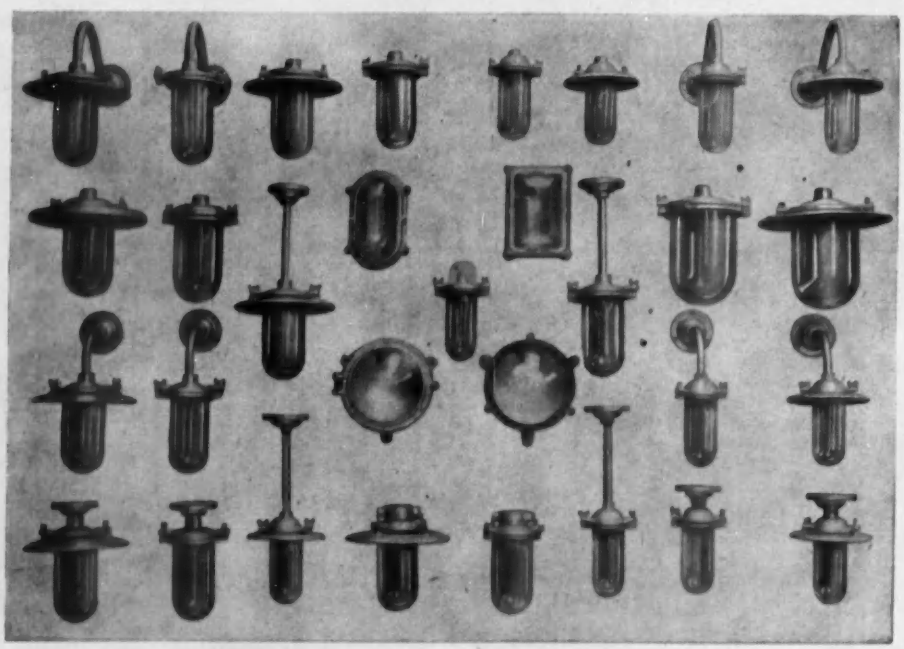

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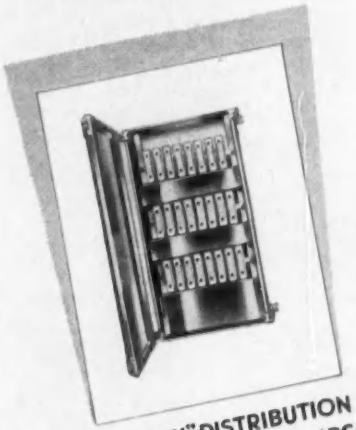

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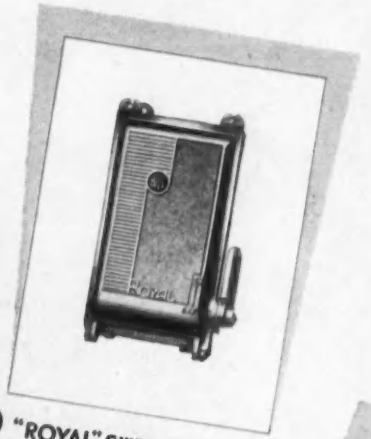

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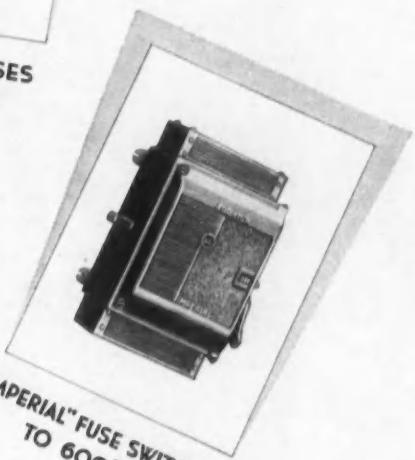

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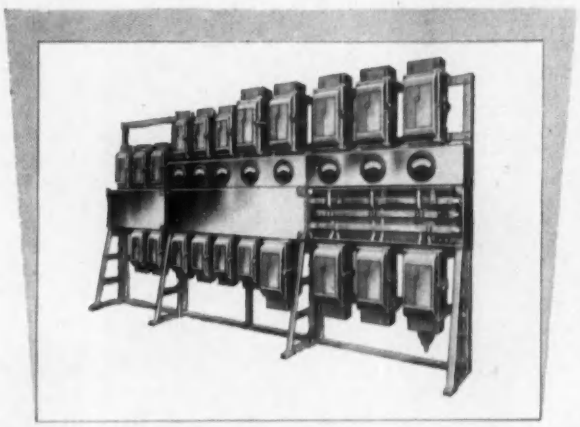

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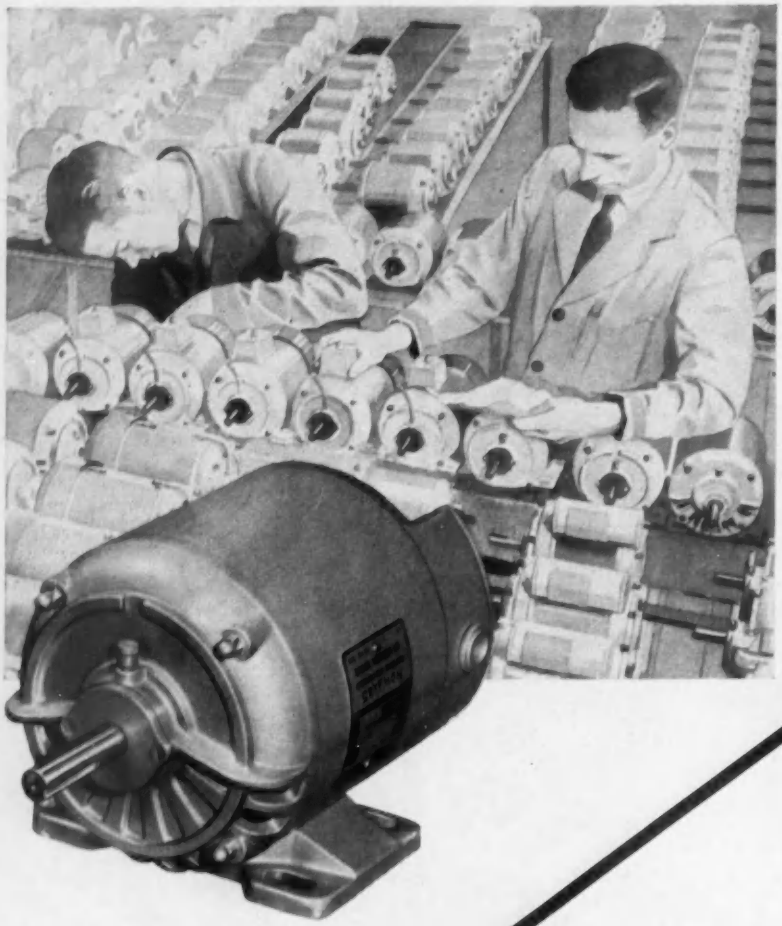

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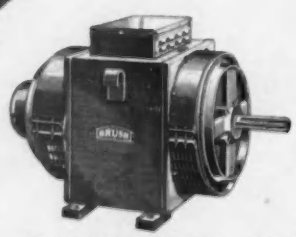

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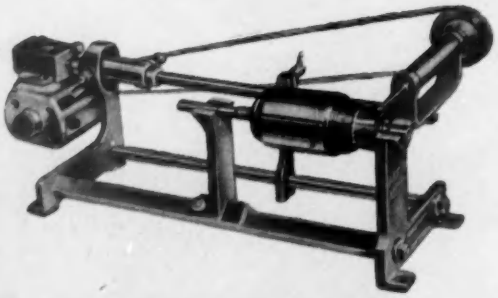

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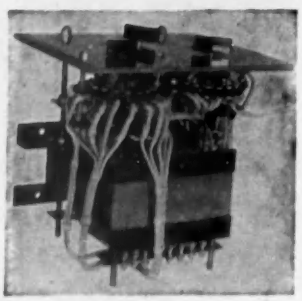

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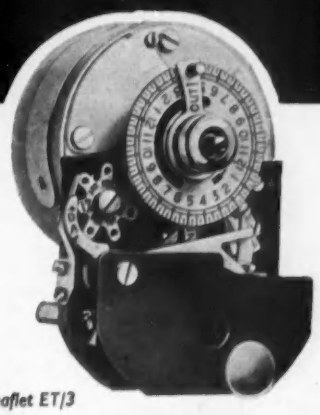

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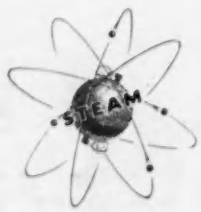

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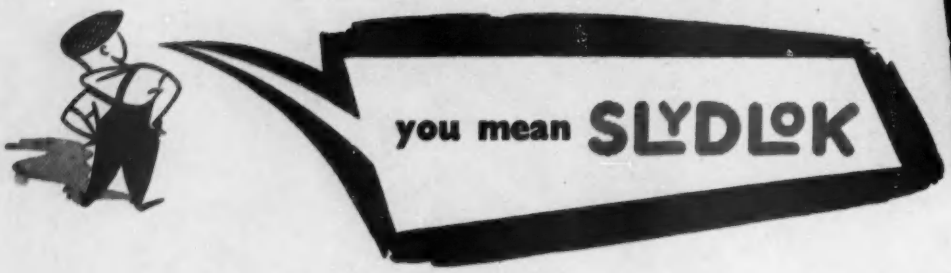

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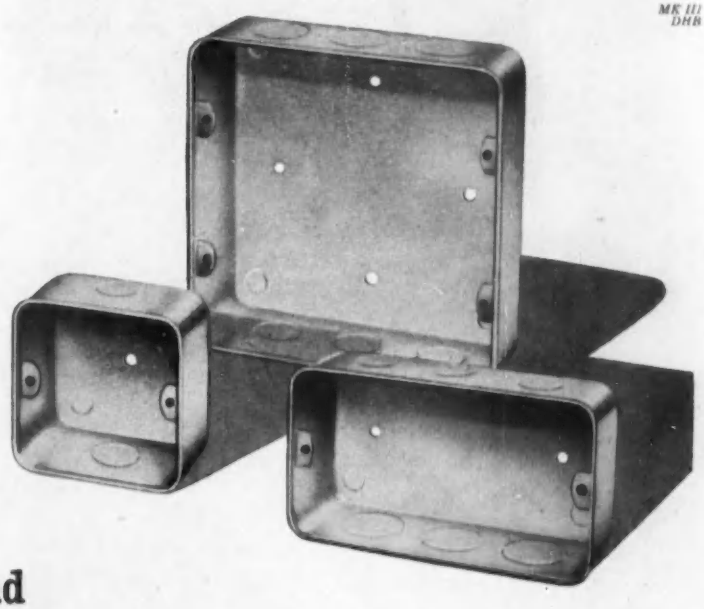

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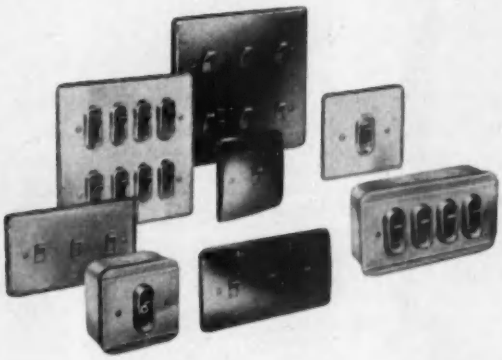

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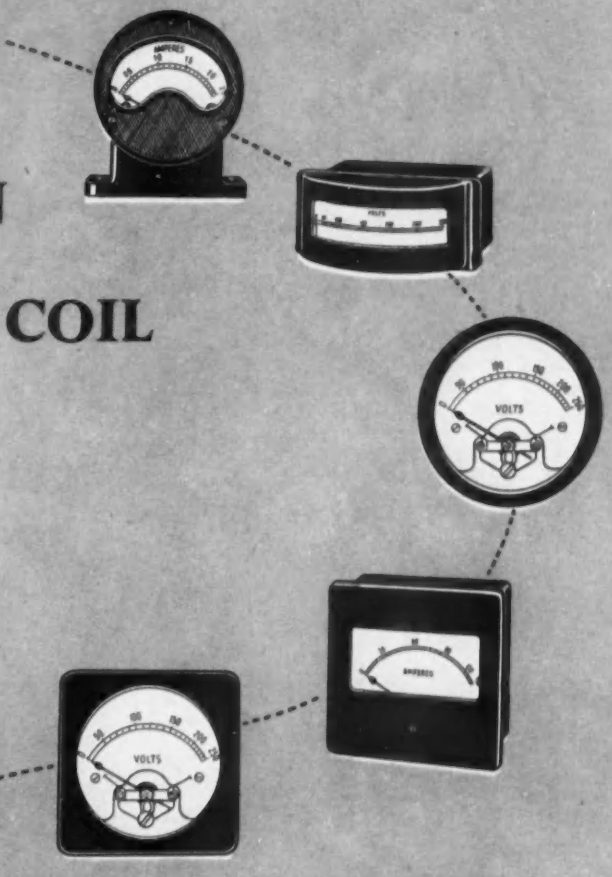

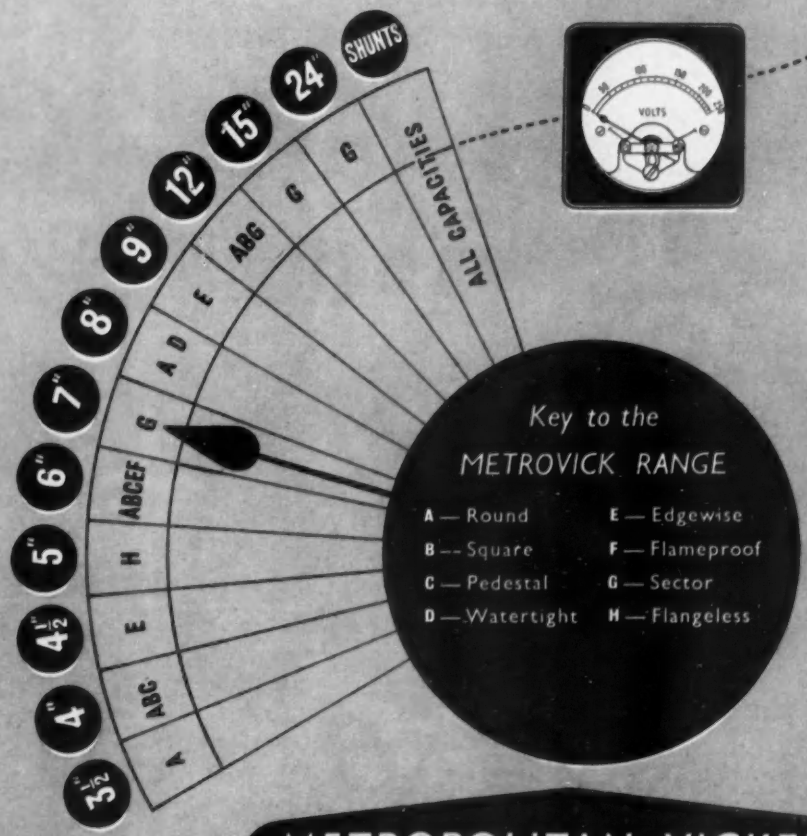

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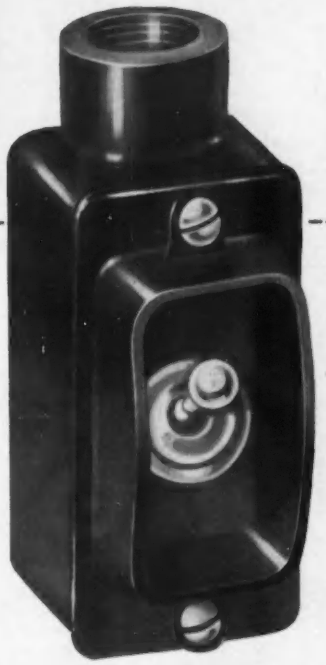

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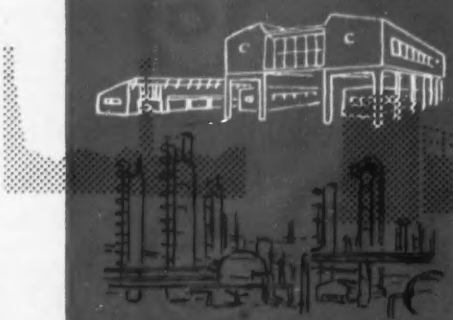

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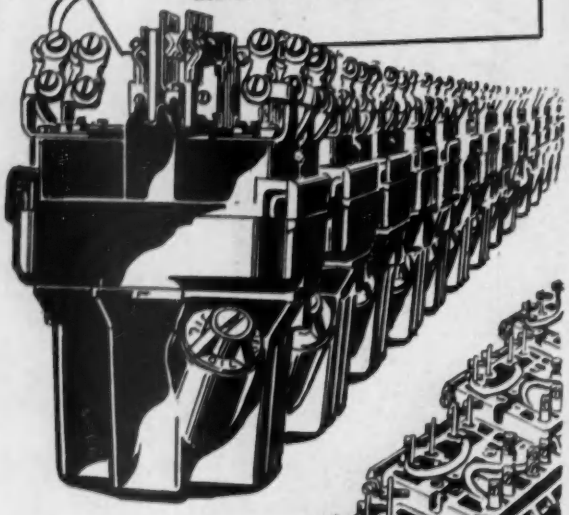

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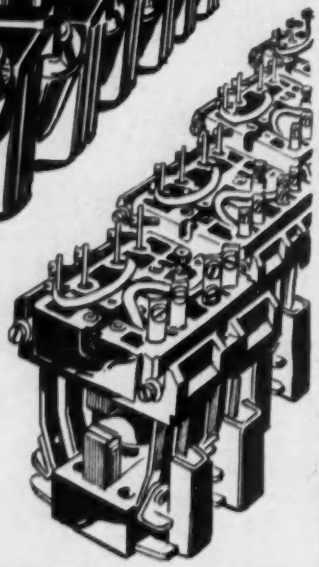

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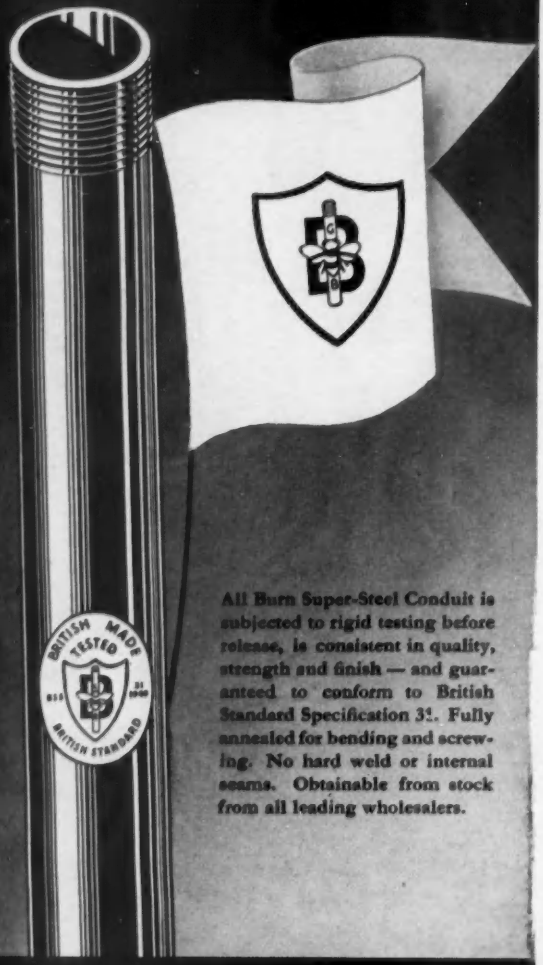

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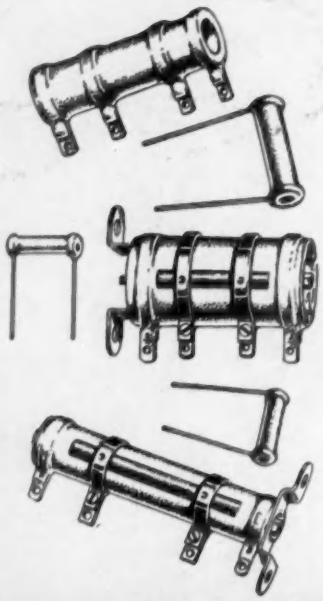

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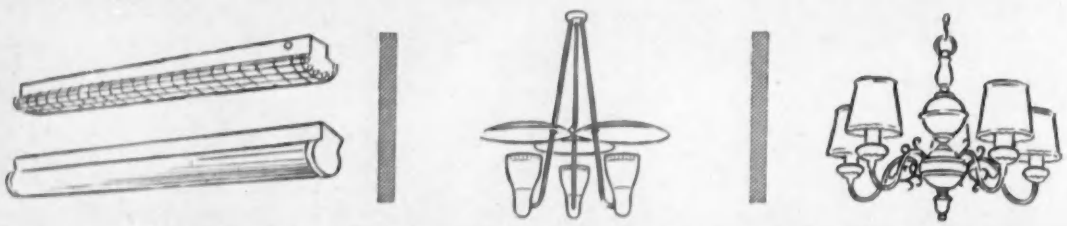

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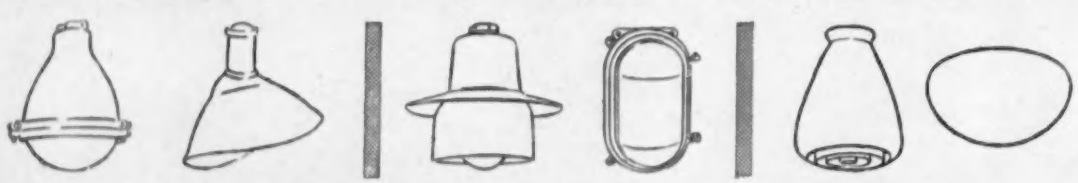

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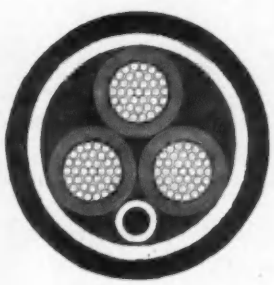

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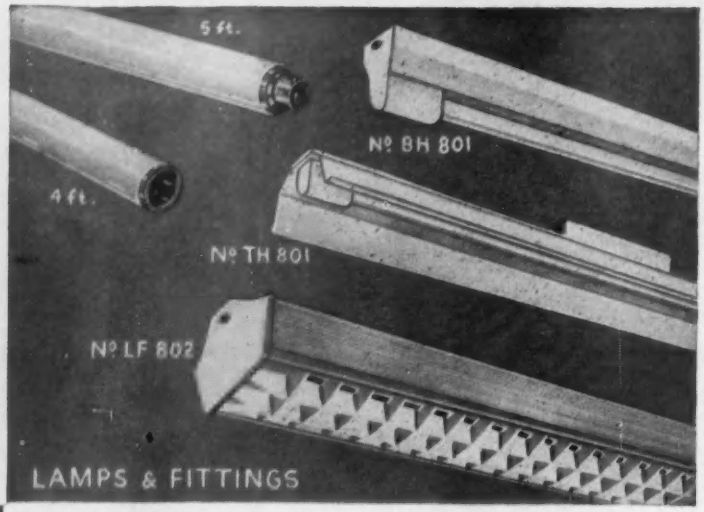

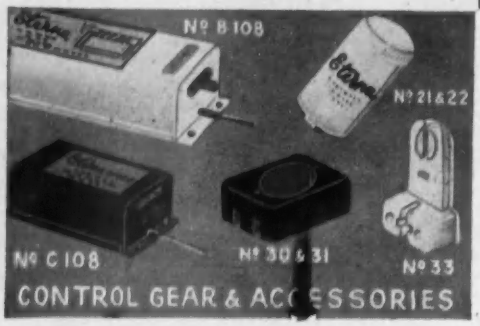

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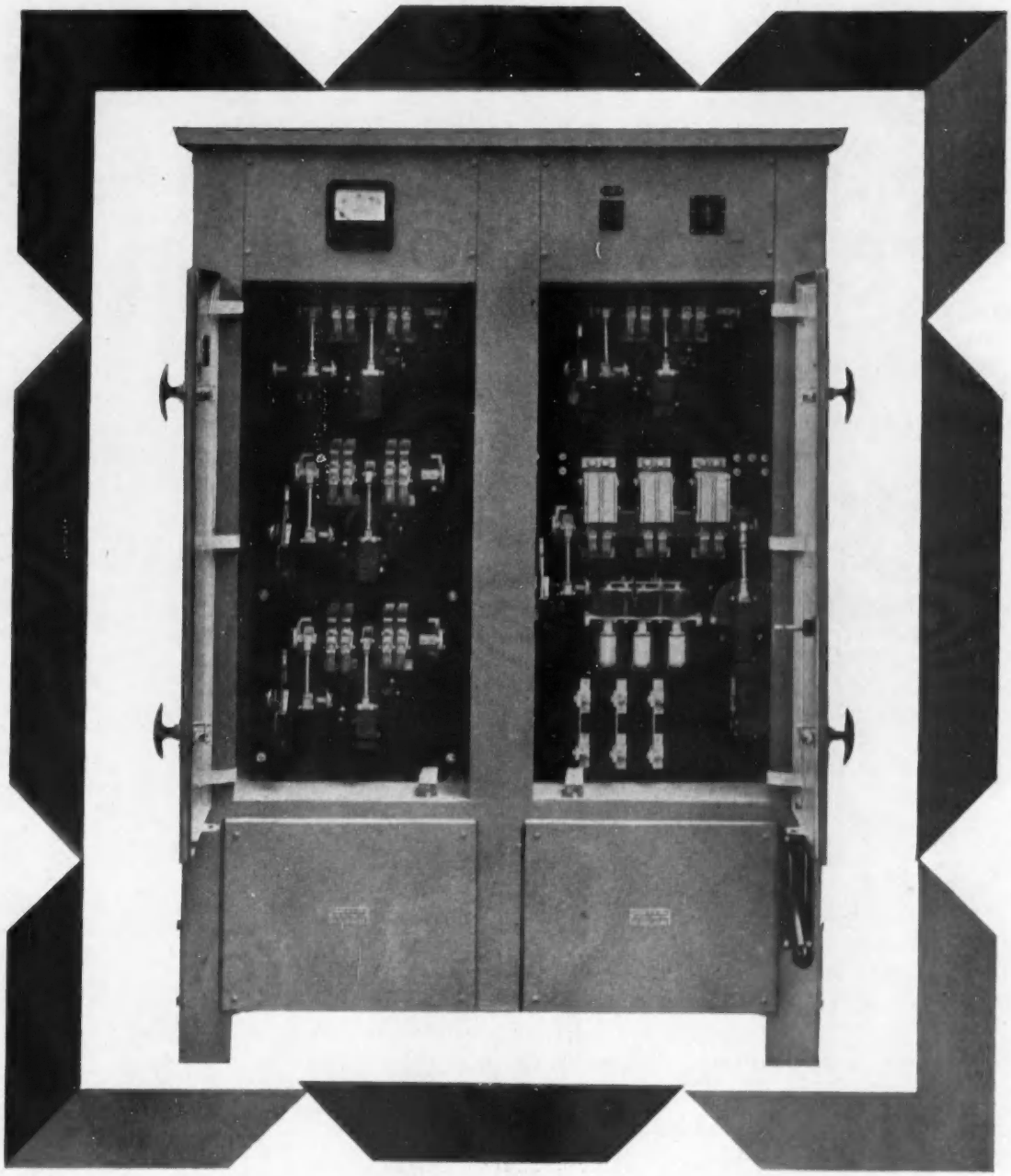

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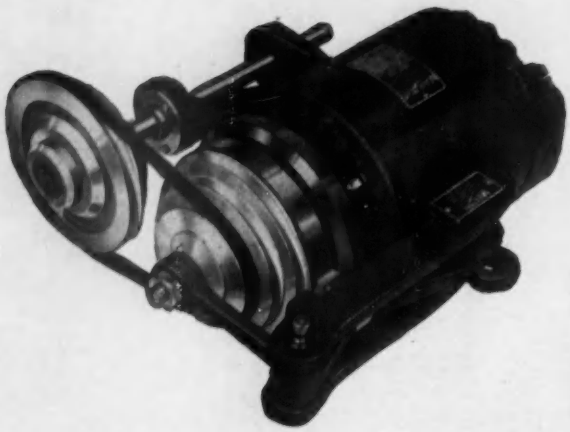

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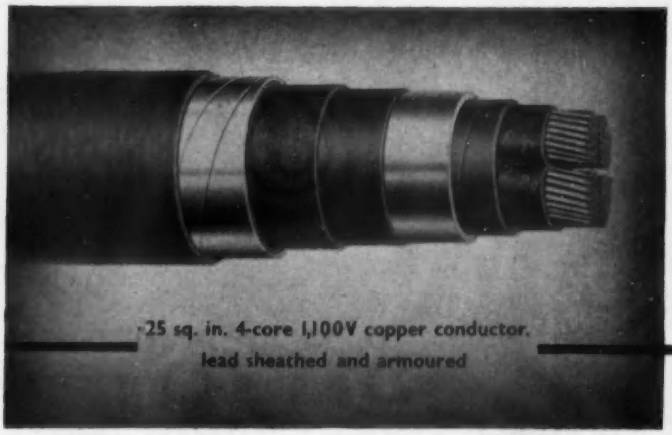

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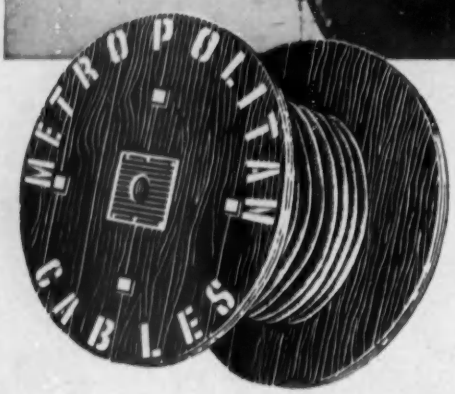

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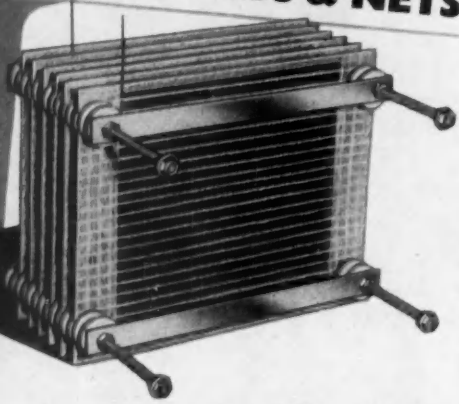

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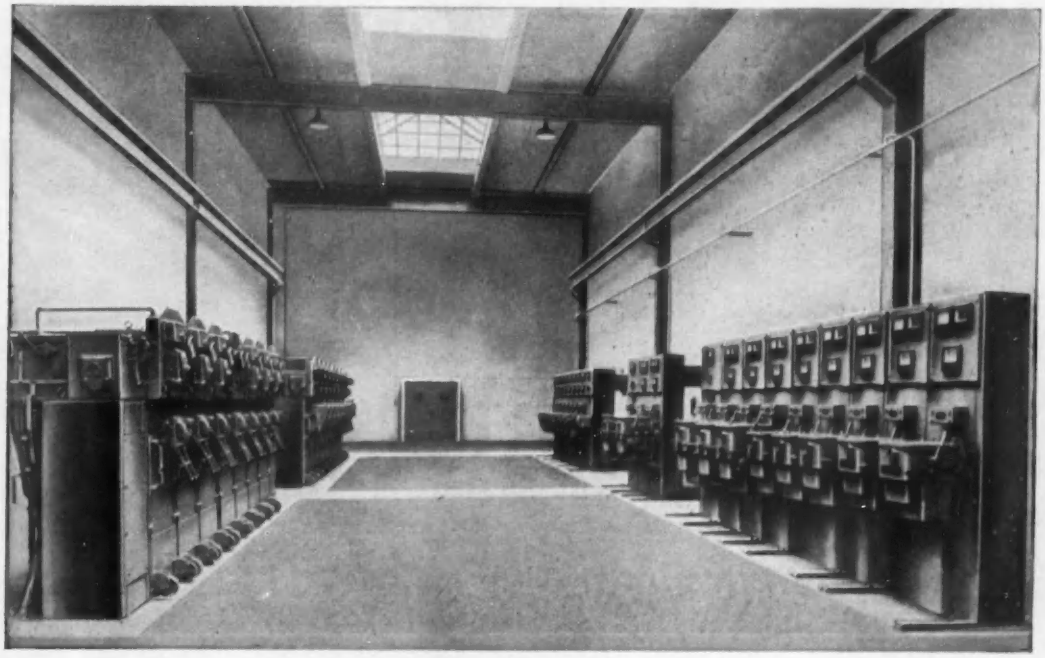

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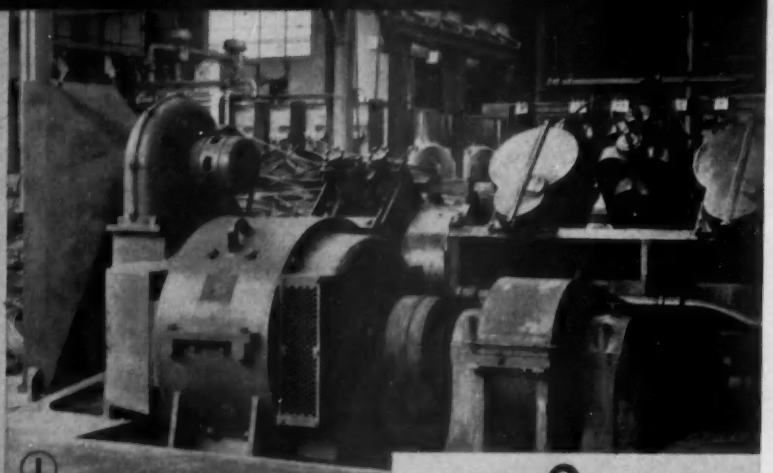

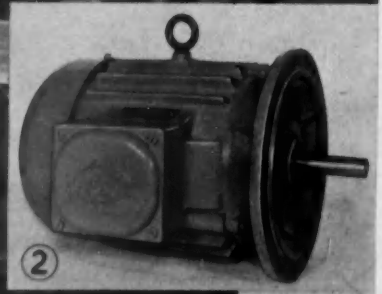

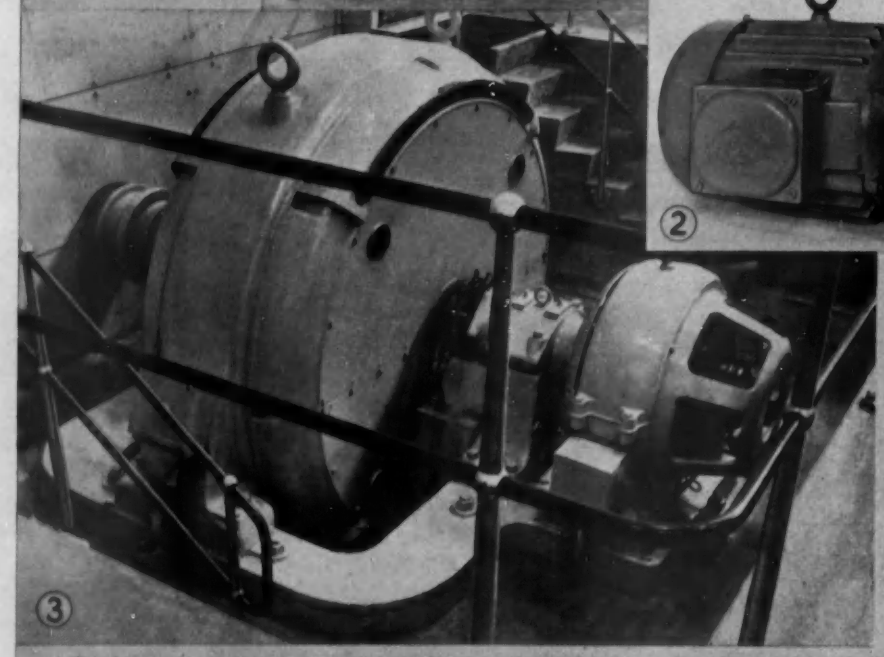

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ELECTRICAL TIMES

ESTABLISHED 1891

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C

BACK TO STEAM ENGINEERING

When the probable outlines of nuclear power station design emerged after the war, it became clear that the nuclear reactor would replace the boiler of the conventional power station, but that the turbine house would remain essentially unchanged. This remains true as a generalisation, but advances in reactor design to give greater nuclear efficiencies are now introducing detailed problems out of the usual run of those met by power station design engineers. This was well brought out in the paper on the pressurised water reactor read to the Institution of Mechanical Engineers last week. Reactors of this type are amongst the most promising candidates for the so-called second-stage programme which will follow the gas-cooled graphite-moderated designs now being developed, and will precede the advanced and highly complicated, self-refuelling breeder reactors which are expected to make up a third programme. Inherent in the design of these reactors, which are likely to use ordinary water as a combined moderator and coolant, is the choice between generation of steam in the saturated state or sacrifice of thermal efficiency to ease the problems of turbine-house operation. Either the problem of excessively wet steam must be faced, or a lower pressure than that otherwise possible accepted in exchange for some degree of superheat. In the opinion of the authors there are a number of closely competing solutions available that will make practicable this reactor, but which is best will depend on the detailed design of turbines and heat exchangers and on the economic balance between external superheaters and intermediate steam drying devices. Unless that is, as the paper hints, it proves possible to expand saturated steam through the turbine without recourse to any external reheater or water separator. The call for developments of this magnitude indicates the importance of the steam engineer in solving the problems of this nuclear age and emphasises the need for experienced engineers as well as near-physicists in the nuclear power programme.

The Editor and staff wish all readers a Happy Christmas and a Prosperous New Year

IMPROVED X-RAY IMAGES

Since the earliest days of radiology the drive has been directed towards obtaining images of greater clarity and definition. To this end tube voltages have been increased and better films and screens developed. Yet even with these aids, radiology in both medical and industrial work leaves much to be desired as a precise and rapid means of diagnosis. A major step forward in the medical field, published some three years ago, was the image intensifier tube, whereby photo-electrons emitted from the viewing screen were accelerated by a high potential gradient on to a secondary smaller screen viewed by an observer through a microscope, or, if required, photographed. Although originally designed for diagnostic work where the actual X-ray dosage received by the patient is a significant factor, it is logical that the image intensifier should have applications in the industrial field. The I.E.E. paper on this subject presented last week well indicates the advantages which can be obtained by the use of this comparatively simple device. The contrast can be improved, due to the use of a lower voltage X-ray tube, and, of even more importance, is the consequent reduction in the size of the X-ray equipment. This will in turn ease the problem of applying X-ray examination to mass-produced articles such as small castings. In addition there is the possibility of extending X-ray proving to a wider general field in the workshop. High-pressure vessel and pipe welds have already to be X-rayed in detail for insurance purposes and if the image intensifier can be used to its full capability in this field alone, it will save much time and money.

MAGNETS TO SUIT

The plea that manufacturers who use specialised components in their products seek co-operation from their suppliers early in the design stage is familiar in every branch of engineering. Sound arguments support the request. If minimum costs are to be attained, the production facilities and design experience of the specialist manufacturer must receive attention on a par with that given to these factors by the principals. There is particular incentive to such action where permanent magnets are concerned. Magnets are finding increasing application in electrical apparatus as the power and compactness of magnetic alloys are improved but in broad terms ever-better magnetic qualities have been accompanied by greater mechanical intransigence, so that considerable design skill is needed to match the magnet to the function it must perform without complicating uneconomically the task of producing the magnet. Happily, the techniques that the magnet firms have developed can meet almost all the requirements, though frequently in a form or shape the designers of the using apparatus will not envisage when they specify a definite flux or a stated pull in a given position. The facts of this case are, of course, well known to the larger users of magnets and in general the magnet manufacturers have established close co-operation with such customers. There remain the many firms which find that the improved permanent magnet can replace some electro-magnetic component which they previously designed and made themselves. In the experience of the magnet manufacturers, too many firms in this category have still not realised the advantages that follow from seeking advice early. Examples of weight and cost saving achieved which we have met in many types of apparatus confirm how worthwhile is such a step.

ERRORS IN TEMPERATURE INDICATION

Temperature and pressure, as the fundamental factors of any thermodynamic cycle, require the most critical measurement, particularly for the assessment of power station efficiency and performance. In addition, with the modern trend toward higher temperatures and pressures, materials at the command of the boiler and turbine designer are being called upon to take stresses, and to operate under extreme conditions, approaching the limit of endurance. Temperature requirements in particular are becoming ever more stringent, and a position has been reached where even a small increase over design conditions may result in severe damage due to overheating of boiler and steam pipes. Thus the accuracy of steam temperature recording and indication systems requires careful investigation. In this connection the recent paper by Lucas and Peplow goes far to resolving some of the causes of error inevitably associated with the difficult task of obtaining a representative figure for the temperature of fast-moving steam in pipes. From the practical aspect the conclusion was drawn that under normal constant conditions of steam flow the majority of errors were small. When, however, steam conditions were altering as at starting or under change of load, the conventional pocketed thermometer had a time-delay in response. But according to the authors, the time-delay error is not unduly significant during the starting-up period, as the steam pipework possesses its own thermal delay which has a compensating effect.

LIGHTING FOR THE SMALL SHOPKEEPER

By the smaller shopkeeper window lighting for display is often regarded as a necessary but expensive adjunct to selling. This is partially because of the relatively few hours during which artificial lighting is required, while the shop is actually open and a positive return being registered. But at the same time, consideration should be given to the prestige value of a well-illuminated window display during the period in which while no sales can take place, may attract passers-by and register in their memories. Two recent important lamp introductions are the fluorescent lamp with tungsten ballast and the internally-silvered tungsten lamp. Both of these open up a new vista in the field of small shop lighting: the former because it is economic in running cost and capital charges, and the latter as it is to a large extent complementary to fluorescent lighting. With these two types of illumination it is now practical to ring the changes on a wide variety of lighting arrangements in shop windows without incurring an excessive cost. The question of artistic arrangement is necessarily beyond discussion here, but the guiding lines provided by Mr Harris in his article, together with the work of E.L.M.A. over the past ten years, should prove that it is well within the compass of the small skopkeeper to provide as attractive a display as his larger competitor.

Meteor

A REVIEW OF MODERN PRACTICE AND EQUIPMENT SPECIALLY WRITTEN FOR CONTRACTORS

BY J. B. HARRIS
A.M.I.E.E., F.I.E.S.

Lighting Shop Windows

DURING the last few years, rebuilding and modernising of retail selling premises has occurred at an ever-increasing rate and artificial lighting has had to keep pace with changing ideas in architectural conception. The main purpose of the shop window is to attract the attention of the passing public by displaying articles to their best advantage and in order to achieve this object there are a variety of approaches, nearly all of which incorporate lighting equipment.

Before the war it was general practice in shop and store layout for display windows (other than those of the island type) to be designed with solid backs and usually the lighting installation consisted of tungsten filament lamps, housed in simple reflectors which were located in conventional positions near the window glass. Attempts which were made to improve the colour rendering properties of the light sources included the use of "daylight blue" filament lamps, tinted reflectors or filter screens and a combined use of high-pressure mercury vapour discharge lamps and tungsten filament lamps.

The two most noticeable tendencies in modern shop and store design are the installation of open-backed windows and the widespread introduction of scenic effects for increasing the attractiveness of commodity presentation. The former permits the public to gaze upon both window display and shop interior whilst the latter leads to an artistic treatment akin to that of a stage set. These two trends, together with the advent of fluorescent and internally mirrored reflector lamps, have revolutionised shop window illumination technique, resulting in artificial lighting being utilised not only in a functional manner but also for the production of dramatic effects. In either instance, however, it is most essential that the lamps be concealed from normal angles of view, failure to observe this fundamental principle resulting in the occurrence of undesirable glare and leading to distraction due to the visible presence of the fittings themselves.

The illustration above is a good example of a modern shop lighting installation indicating the technique of open back windows. (Philips Electrical Ltd.)

There is no simple formula for planning shop-window lighting and its correct execution will depend upon a number of factors—the nature and quality of the goods being displayed, the architectural design of the shop and its topographical location. Moreover, although lighting control is a matter of scientific design, engineering efficiency sometimes becomes of secondary importance, particularly where the attainment of artistic effects is desired. In the larger type of store window, an adequate number of socket outlets should be provided to permit of flexibility in meeting the demands of displays which are frequently changed in character.

The subject of spectral quality of the light sources never fails to provoke discussion, particularly since the introduction of fluorescent lamps. The tungsten filament lamp is an incandescent light source which emits radiation having a preponderance of red rays. Although its spectrum differs from that of daylight, it has always been regarded as an artificial standard and any departure, for general lighting purposes, is looked upon with suspicion by the lay public. From the optical aspect, tungsten lamps due to their high brightness and small source size, can be easily and accurately controlled as regards light distribution. As light flux producers, however, they are relatively inefficient and consequently they produce a high proportion of radiant heat. Thus it becomes more economical, in respect of running costs, to obtain high values of illumination by means of fluorescent lamps, although (*a*) they produce a very diffused light which tends to "flatten" appearances due to the absence of hard shadows and (*b*) their colour rendering properties may not be suitable for all displays (even though there are a variety of "white" lamps available).

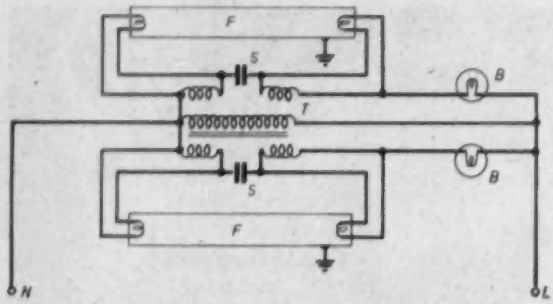


Fig. 1. Standard instant-start circuit for twin fluorescent lamps employing tungsten filament lamp ballasts. Key: S = suppressor capacitor; T = filament heating transformer; B = tungsten ballast lamp; F = fluorescent lamp

Displays of glassware, plate, jewellery and the like are instances where tungsten filament lamps are found to be superior, whereas some types of merchandise may require artificial daylight conditions which are best obtained by means of "colour matching" or "daylight" fluorescent lamps. Investigations carried out by the E.L.M.A. Lighting Service Bureau indicate that a mixture of both types of source is generally acceptable, although the colour of the fluorescent lamps will depend upon the type of goods being displayed.

Lighting Equipment

Considering equipment utilising tungsten filament lamps, general lighting purposes are served by reflectors of mirrored or prismatic glass or highly polished, super grade, aluminium. They are often dimpled or rippled in order to avoid filament striations when using clear glass lamps and, when required for use adjacent to the top of the window glass, they have an asymmetrical distribution. Selection of the two main types, intensive or extensive, is determined by reference to the height and depth of the window and display. An alternative method (sometimes used in conjunction with the above for deep or island windows) consists of symmetrical circular section reflectors which are positioned directly above the display, recessed in a false ceiling.

For accent or floodlighting, reflectors of parabolic contour and having a means of adjustment for varying angular projection, are sometimes employed. The introduction of the reflector spotlight lamp, however, has led to its universal adoption for high intensity lighting. Although these lamps are higher in cost than general service lamps of similar rating, they possess the advantages of smaller overall size, non-deterioration of the sealed parabolic reflecting surface and higher efficiency due to accurate focal positioning of the filament. The density of etching of the crown of the bulb and the design of the filament ("ring" or "grid") determines the shape of the light distribution curve.

Lamps are available in 75, 100, 150, 250 and 500 W ratings for use on 110 V and 200/250 V supplies. A transformer fed 24 V, 150 W, spotlamp, having a maximum beam intensity of about 18,000 candela is also available.

If the lamps are concealed from view, they only require to be inserted in an adjustable lampholder. If, however, they are likely to be within the normal sight line, they should be enclosed in a metallic housing. Spill shields or concentric circular louvres may also be necessary to avoid side glare and some firms supply colour filters as an optional extra. If directional control is required, when the lamps are inserted in a false ceiling, an "eyeball" unit giving adjustability up to an angle of 45° from the vertical, should be used.

For highly-concentrated light beams, projector lamps having a lens system of optical control may be used. One firm has introduced a compact unit utilising a 24 V, 48 W, projector lamp which, together with masking slides, permits sharp definition to be obtained to suit the shape of the object concerned.

In using fluorescent lamps, an extensive range permits of their application to the many sizes of windows requiring treatment. For uni-directional viewing, the conventional method consists of lamps housed in specular reflectors arranged horizontally along the top front of the window.

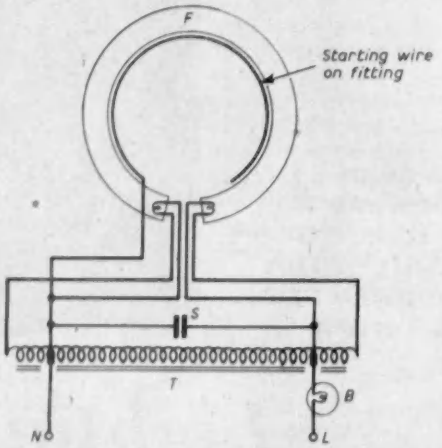


Fig. 2. Instant-start, tungsten lamp ballast circuit for use with the 40 W fluorescent circle, identical in principle with that of Fig. 1. The same key applies to the lettering

Reflectors, generally of parabolic section, are fabricated from heavy gauge aluminium, which is polished and anodised on the working surface. End brackets are sometimes provided for facilitating angular adjustment on site. Usually fittings are of the multi-lamp type, as up to four lamps per unit run may be required for main road windows. For screening the equipment, pelmet boards should be used and if side viewing is possible, frames of lateral louvres should be added. Additional lighting for the rear of the display area may be necessary in very deep windows and one way of achieving this is to install additional reflecting equipment on the ceiling which can be screened with longitudinal baffles.

Lamp Concealment

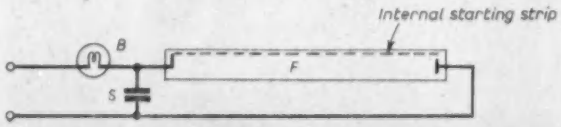
For re-entrant, island and open-back windows, the question of lamp concealment becomes of great importance and the installation of decorative ceiling fittings is not a happy solution. One satisfactory method is to recess trough-shaped reflectors in the ceiling and screen the lamps by means of flush louvre frames giving a shielding angle of about 45°. An alternative system, which is rapidly gaining in popularity, entails the installation of a completely louvred ceiling constructed of hinged louvre frames. The louvres themselves, usually formed of square cells, are of aluminium, steel or plastic material and the fittings (plain battens are suitable if the cavity above has high reflection characteristics) are arranged in lines to produce a fairly uniform ceiling appearance. This calls for a spacing between lines not exceeding twice the height of the fittings above the louvres. In order that the lighting system does not become too significant a feature, it is sometimes found desirable to finish metal louvres in a dark grey matt paint.

There is a growing tendency to install fluorescent lamps in vertical positions in the corners of windows in order to

avoid shelf shadows and even-up the illumination down the window. Unfortunately, in the majority of shops employing this method, no precautions are taken to screen the lamps which, in consequence give rise to a high degree of glare affecting visual appreciation of goods and impairing the night vision of drivers of vehicles.

All ratings, other than 125 W, of fluorescent lamps can be obtained in standard colours of red, green, yellow and blue which is useful when treating special features. Schemes of this kind may also benefit from the use of a control unit for blending colours, enabling the light from two coloured 80 W lamps to be mixed in varying proportion with that of a white tube. By this means, with one white, one red and one blue lamp, it is possible so to adjust the setting as to obtain a variation from cool blue (suitable for winter wear goods) to warm pink (for evening dresses). All three lamps would be housed in one standard reflector.

The use of ultra violet rays for irradiating fluorescent materials has a novelty value which is often exploited by window display artists, and tubular lamps, of the same dimensions and operating characteristics as the normal 20, 40 and 80 W fluorescent types, offer many advantages. Not



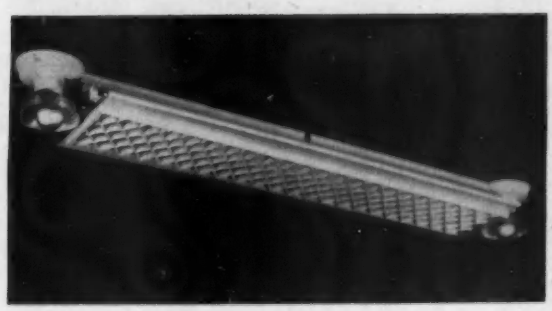


Fig. 3 (a). The "gearless" circuit for a single 40 W fluorescent lamp, employing ballast and fluorescent lamps of special design. Key as in Fig .1. (b) Twin lamp "gearless" fitting. (Philips Electrical Ltd.)

only are they more efficient in radiation production and quicker in starting than the high pressure mercury vapour type but their shape facilitates their application to large area displays. "Woods" glass filters are used for absorbing the small amount of visible light emitted by these special lamps.

Lampholder Selection

When using bi-pin lamps with conventional type "button" or "tombstone" lampholders, contact is obtained by simultaneous insertion of the caps followed by a twisting motion. As these holders are fixed in position, there is little allowance for variation in lamp length and in addition care has to be taken to avoid loosening or fracturing the pins. During service it often happens that, due to vibratory causes, there is a breakdown in electrical contact at the pins and the lamps fail to function. For this reason some engineers insist on the use of mechanically rigid springloaded lampholders in which lamp rotation, following pin insertion, is not required. Alternatively the lamp itself can be supported in spring clips, electrical connection being obtained by means of friction fit, plug-on holders. It is also possible to purchase socket type adaptors for use with bayonet cap lampholders. For the 80 W fluorescent lamp, which has standard bayonet contact caps, cord-grip holders are normally used, but there are many advantages to be gained from using a fixed type, plastic moulded, spring-loaded, lampholder which is supplied complete with a flicker shield. Not only is variation in lamp length and thickness of solder contact catered for, but lamp changing itself becomes far easier. An earth terminal is also provided for facilitating contact with the metallic ribbon of earth strip lamps.

Fluorescent Lamp Circuits

There are many types of circuits available for use with fluorescent lamps, which can be divided up into two main classes of either starter switch, or quick start operation. In starter switch circuits the main items of control gear comprise choke, power factor capacitor and thermal or glow type starter switch. These are mounted and wired up as either separate items or enclosed in a common housing with mains terminals and flying leads for connection to the lampholders. The control gear may be mounted in the body of the fitting or it can be installed in a remote but more easily accessible position outside the window area.

Although more costly as regards initial installation, the latter course may be considered preferable, particularly if access to fittings is difficult and control gear is likely to be subjected to high ambient temperatures possibly causing overheating and exudation of compound fillings. To overcome this hazard the use of chokes of an uncompounded type has been suggested and also a number of firms are using high temperature resistant capacitors which have a chlorinated diphenyl impregnant. Apart from the cost of replacement as consumable items, the main disadvantage of starter switches is that failure may occur during hours of shop closure, resulting in repeated lamp flashing.

Quick Start

Numerous choke ballast circuits are being used in which starting is almost instantaneous, as distinct from the three

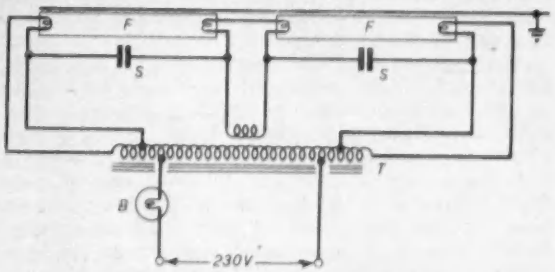


Fig. 4. Instant start twin lamp circuit recently developed for either 4 ft, 40 W or 5 ft, 80 W fluorescent lamps employing one 120 V, g.l.s. tungsten filament lamp of 100 W and 150 W respectively, for ballast. Key as in Fig. 1. (Inductive Appliances Ltd.)

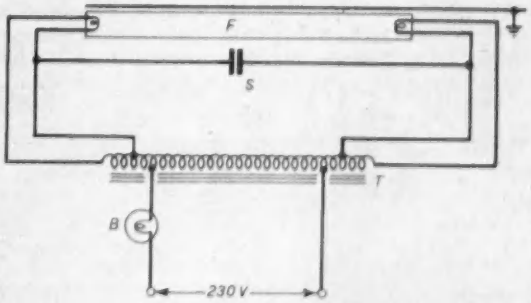


Fig. 5. Instant start circuit for single 8 ft, 125 W fluorescent lamp which uses a 120 V, 150 W, g.l.s. tungsten filament lamp as ballast. Key as in Fig. 1. (Inductive Appliances Ltd.)

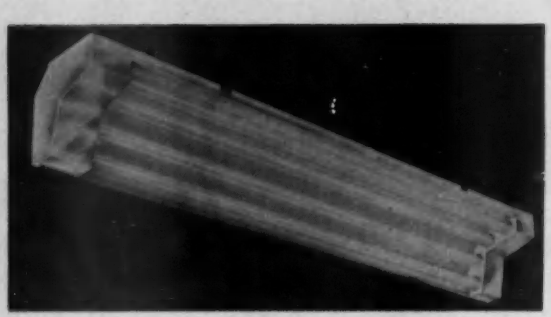


Fig. 6. "Atlas" four-lamp corner fitting (FYQ 4080) which is eminently suitable for shop window installations

to four second delay (sometimes accompanied with flashing) which occurs in starter switch circuits. Heating up of the electrodes is effected by means of a high reactance auto-transformer and consequently the starter switch may be omitted. Some firms state that for surety of starting, it is necessary to use either an "earthstrip" lamp or a lamp which has had its surface treated with a silicon coating. Other manufacturers supply a complete ballast unit which will operate a normal, untreated lamp, provided that an earthed conductor (the body of the fitting for instance) is positioned not more than 1 in. away.

Lamp life is not likely to be less than with a conventional circuit and there is less possibility of failure to start should there be a more than normal drop in the voltage of the supply. A small unit has been manufactured which can be inserted in an existing starter switch circuit for converting it to "quick start" operation. The cost of this transformer would soon be recovered by the savings effected in starter switch replacements.

Tungsten Ballast Lamp

The characteristics of tungsten filament lamps enable them to be utilised for controlling the current of a discharge lamp instead of the choke and this principle, which has long been applied to certain types of mercury vapour lamps, has been adopted in a number of fluorescent lamp circuits. Apart from the normal reasons for using tungsten filament lamps in addition to fluorescent lamps, the advantages offered in regard to shop window use are: (i) There is little, if any, loss in control gear; (ii) the absence of choke and p.f. capacitor results in a less weighty fitting; (iii) the hazards of fire and consequent damage are avoided; (iv) by arranging for group replacement of lamps, the possibilities of lamp failure occurring during hours when the shop itself is shut are reduced; and (v) circuits will require less attention for electrical maintenance.

The standard twin lamp circuit with tungsten ballast lamps (Fig. 1) employs an auto-transformer which serves two "instant start" 40 W fluorescent lamps, each of which is connected in series with a special pearl tungsten filament lamp. Not only is the choke dispensed with but the high power factor of the circuit renders the p.f. capacitor unnecessary. A similar circuit is also available for operating the circular 40 W fluorescent lamp (Fig. 2) and this might be found useful in special fittings or display sets.

TABLE 1.—LUMEN EFFICIENCY OF TUNGSTEN LAMPS USED AS BALLASTS IN FLUORESCENT LAMP CIRCUITS

Mains Voltage (a.c.)	Ballast Lamp Watts	Light Output in Lumens (initial)	Type of Circuit
220/230	60	635	Straight length 4 ft. 40 W fluorescent lamps.
240	65	685	
250	70	735	
220/210	70	705	Circular 40 W fluorescent lamp
220/230	80	845	
240	80	850	
250	80	865	

From the technical data given in Table 1, calculations can be made of overall efficiency, as compared with that of a normal choke operated circuit in cases where a 75 W lamp (of B.S. rating) is used in addition. (Allowance must be made of course for the watts loss in the gear of the ballast lamp circuit.) The ballast lamp, as used for shop window lighting, may be mounted in the fluorescent lamp fitting or in a separate reflector.

To date, the "Gearless" circuit (Fig. 3) represents the simplest method of operating a fluorescent lamp. It comprises a special 40 W fluorescent lamp connected in series with a special tungsten filament lamp ballast, the whole

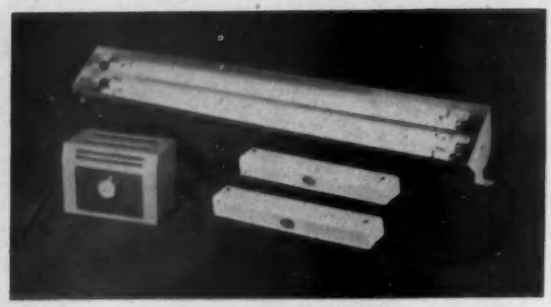


Fig. 7. Triple lamp dimmer circuit showing fitting and control gear. (Thorn Electrical Industries)

having a power factor of about 0·97. The former is fitted with an internal metallic strip which facilitates instant starting whilst the filament lamp replaces all other auxiliary gear except the suppressor capacitor. There are single contact connections to the cap of the fluorescent lamp necessitating the use of special lampholders and, to avoid the possibility of mistaken insertion, the tungsten lamp is fitted with a three pin bayonet contact cap. From Table 2 it will be seen that the total cost of a fluorescent lamp and a mirrored spotlight lamp is only slightly higher than that of a standard instant start fluorescent lamp, plus a standard 75 W spotlight lamp. Although special lampholders are required, the cost of these is far less than a set of instant start control gear together with bi-pin lampholders and other accessories. Calculations reveal that there is little difference in overall luminous efficiency between the two methods and this fact should receive

TABLE 2.—TECHNICAL DATA FOR CIRCUITS OF THE "GEARLESS" TYPE

Fluorescent Lamp	Colour Designation	Light Output in Lumens (ave. thru' life)	Tungsten Lamp Ballast			Light Output in Lumens (ave. thru' life)
			Mains Voltage	Lamp Watts	Type	
Type MCFB/U 4 ft. 40 W. 220/250 V. a.c. (List Price 15s. 7d.)	Natural ...	1600	220/230	70	Internally mirrored spotlight (List Price 9s. 5d.)	692
	Daylight ...	1680	240	75		743
	New Warm White ...	1880	250	80		790
	De Luxe Warm White	1100				
	Colour Matching	1160	220/230	70	Internal reflector bowl	692
			240	75		743
			250	80		790
			220/230	70	Opalescent internal coating	735
			240	75		790
			250	80		840

TABLE 3.—FLUORESCENT LAMP DATA

Lamp Rating (watts)	Nominal Length (ft)	Nominal Diameter (in.)	Nominal Average Light Output Throughout Life (Lumens)					
			Daylight	Natural	New Warm White	Colour Matching	White	De Luxe Warm White
125	8	1½	6000	5375	6875	3875	—	—
80	5	1½	3920	3120	4160	3040	4160	2560
40	4	1½	2040	1640	2160	1600	2160	1360
40	2	1½	1240	1080	1320	760	1360	760
30	3	1	1350	1170	1380	840	1470	840
20	2	1½	760	640	800	460	900	460
15	1½	1	495	420	510	330	510	330

Apart from the above, the following fluorescent lamps can be obtained as standard: 8 ft. 50 and 70 W, 5 ft. 50 W, 3 ft. 30 W (1½ in. dia.), 1½ ft. 15 W (1½ in. dia.) and a 40 W circular lamp (dia. of circle 16 in., dia. of tube 1½ in. nom.).

serious consideration when preparing estimates of comparable lighting schemes.

In another recently developed circuit there are several features which should be of appeal where initial costs are required to be kept to a minimum. The basic circuit consists of a standard 120 V general service tungsten filament lamp, a filament heating transformer and one or two standard instant start fluorescent lamps (see Figs. 4 and 5). The transformer, which has flying leads together with a terminal block for connection to the ballast lamp, is of relatively small size (6½ in. x 3 in. x 2 in.) and could be located near the lamps. The tungsten lamps could be housed in parabolic, spun aluminium reflectors in order to give a high intensity "punch." The total light emitted by the lamps may not be equivalent to that of the rated output of lamps in normal circuits but there are many instances where, in the interest of commercial expediency, such losses would be acceptable.

Measuring Steam Temperatures

ACCURATE measurement of steam temperature is necessary for the correct assessment of turbine efficiency and, at advanced temperatures, for the protection against overheating of the pipe wall. Although the sources of possible error have been known for many years, a theoretical analysis in detail leading to the derivation of quantitative values presents considerable difficulty. An attack on this problem was described last week at an I.E.E. Supply Section meeting when Messrs D. H. Lucas and M. E. Peplow presented a paper "The Measurement of Steam Temperatures in Power Stations."

They began by enumerating the causes of error. These were (*a*) incomplete mixing of the steam arriving in a pipe or receiver from different sources; (*b*) variation in temperature over the cross-section of a steam pipe; (*c*) difference in temperature between steam and thermometer pocket; (*d*) difference in temperature between pocket and thermometer; (*e*) slow response of the thermometer under changing steam conditions and (*f*) inaccuracy of the measuring instruments.

A fundamental mathematical attack was made, and a general conclusion reached that any arbitrary form of temperature distribution in a steam pipe reached an equilibrium form in a pipe length of about eight times the diameter. Thus serious errors in temperature measurement could be avoided by making the measurement at a suitable distance down-stream from the junction of two pipes. This equilibrium condition was brought about by the diffusion of heat in the steam within the pipe. A temperature gradient, however, would continue to exist in the pipe due to the loss of heat from the pipe wall. This was a maximum very close to the wall but was of small proportions across the major part of the pipe. The gradient was naturally determined by the pipe temperature, a factor which also affected the thermometer pocket which was mechanically connected to the wall. Further effects in this connection were the localised heat loss from the pipe due to removal of lagging around the pocket and the loss of heat due to the conduction of the thermometer itself wihin the pocket to the outside air. The time lag error of a thermometer inserted directly in the steam was much smaller than that of one in a pocket, although this was probably the only respect in which an immersed thermometer was superior in accuracy to a properly designed pocket thermometer. During the warming up period, rates of change of temperature could be very great, and errors due to the time lag of pocket thermometers might be as high as 20° F. However, the pipe concerned would certainly have a greater time lag than the thermometer and should not be endangered. Where, however, the steam-temperature measurement formed part of an automatic boiler control system, the time-constant of the thermometer could be a vital factor.

Two other errors were due to the steam velocity and the instrument. If the speed of steam along the pipe became comparable with the thermal velocity of its molecules it affected the apparent temperature of the steam. At Deptford West, the value of this error was about 0·17° F. Instrument error using platinium resistance thermometers could be made as low as ± 0·003° F. At Deptford West, the error was about ± 0·2° F. Thermocouples were much less accurate, the error figures lying between ± 1° F and ± 5° F.

The paper continued by describing practical work carried out at Deptford West to verify the theoretical basis. It was concluded that two streams of steam entering a single pipe were thoroughly mixed in a length of about 30 diameters. The temperature gradients in high velocity steam in a well lagged pipe were negligible except near the pipe wall. Errors could be made negligible with pocket thermometers by special design (with the exception of the time lag error) and finally, the difficulty and risk associated with immersed thermometers did not justify the additional accuracy available.

The steam conditions at Deptford were: pressure 400 lb/sq in. and temperature, 775° F. To measure the temperature variation across the cross-section, and to estimate the mixing effects, a pipe some 13 in. dia. was selected below a junction and lagged with 3 in. thick magnesia plastic and carrying steam at 140,000 lb/hr, giving a steam velocity of 65 ft per second. Several thermometers were inserted into the pipe, one being pocketed and others of the direct immersed type. It was apparent that when the steam flow was low, there were considerable differences between the readings of the thermometers. As the flow increased, the differences became less until under normal conditions six of the nine thermometers concerned agreed to within ±0·35° F. The pocketed thermometer read low.

It was found that when the steam temperature varied sinuosoidally with an amplitude of 9° F and a period of 18 min, the measured temperature with a pocketed thermometer had an amplitude of 8° F and a lag of 1 minute. The maximum discrepancy was nearly 3° F.

PRESSURISED

Steam Side

GAS-COOLED graphite-moderated nuclear reactors such as will be used in the first of Britain's nuclear power stations are recognised as being but the simplest of a long line of reactors which will eventually be evolved. One of the most promising of the more advanced types is the pressurised-water reactor. Such a reactor was considered as a source of heat for steam power plants in a paper read to the Institution of Mechanical Engineers last week by Messrs J. M. Kay, M.A., PH.D., A.M.I.MECH.E., and F. J. Hutchinson, M.ENG., M.I.E.E., M.I.MECH.E. (both with Kennedy and Donkin).

The core of the pressurised-water reactor will consist of a cylindrical assembly of fuel elements arranged in lattice formation and housed inside a pressure vessel. Each fuel element will normally be located inside a coolant channel or duct, and water will be circulated at a fairly high velocity to secure the required rate of heat removal. The moderator and coolant water must normally be pressurised to prevent boiling occurring inside the core.

In this paper, the authors do not attempt to discuss the detailed problems of fuel element and core design for such a reactor. Rather, they seek to put engineering limits on the rate of heat removal, pressures, etc., and hence to examine the practicability of the pressurised water design generally. Thus the canning and composition of the fuel elements are assumed to be known in general terms. A possible design based on present knowledge is a light-water moderated and cooled reactor having between 40 and 50 tons of slightly enriched uranium in the core. If the design aims at a total heat output of 500 MW (heat, not generated electricity) the average fuel rating will have to be about 20 million B.Th.U./hour/cu ft of core volume. This could be achieved from considerations of heat transfer with circular rods of slightly over ½ in. diameter, or with fuel elements of a different shape having the same effective diameter. It is likely to be desirable to group elements in some way for convenience in charging and discharging. Table I shows the heat flux and thermal stresses that will result from various diameters of fuel rod, in terms of the hoop stress in the element sheath.

TABLE I.—HEAT FLUX AND THERMAL STRESS IN FUEL ELEMENTS WITH 1/32 IN. STAINLESS STEEL SHEATHS, FOR 20×10^6 B.TH.U./HR/CU FT OF CORE VOLUME

Fuel-rod diameter	in.	½	¾	1
Average surface heat flux	B.Th.U./hr/sq ft	208,000	312,000	416,000
Max. surface heat flux	B.Th.U./hr/sq ft	312,000	468,000	624,000
Max temperature difference through sheath walls	°F	44·5	67·4	90
Hoop stress	tons/sq in.	4·82	7·28	9·7

The next question considered by the authors is the design of the pressure vessel enclosing the core. The core diameter itself will be between 6 ft and 8 ft for a light water reactor of this type, and somewhat larger for a heavy water reactor. Taking the case of a light water reactor, a pressure-vessel of diameter 9 to 10 ft will be required. From this dimension, the permissible pressure in the reactor may be fixed, since this will depend on the thickness of shell acceptable, and that in turn is a matter of welding techniques. Probably 7½ in. thickness is the limit, and this implies 1,500 lb/sq in. internal pressure. Taking this as the limiting reactor pressure, the corresponding saturated steam temperature is 596° F, and maximum temperatures throughout the plant are derived from this. In practice, some margin of safety will have to be allowed, and the authors take the maximum temperature as 576° F.

With elements of ½ in. equivalent diameter, the temperature difference between the hottest point on the fuel element sheath and the inlet coolant temperature can be kept down to 100° F without employing excessive water velocities. The coolant temperature rise depends on the geometry of the coolant channel, and 36° F is taken as a typical figure. Resulting temperatures are 476° F for the coolant at inlet, and 512° F at outlet from the core. The maximum temperature at the centre of the uranium will be 786° F.

The hot water will be taken to a heat exchanger in which the condensate from the turbines is heated. A steam pressure of 450 lb/sq in. is assumed, with a corresponding saturation temperature of 456° F. The feed water is assumed to be heated to 315° F by bled steam heating before it enters the exchanger. For a heat load of 500 MW, the total surface area required will be about 50,000 sq ft. The steam and water mixture leaving the heat exchanger will be separated in a boiler drum associated with, but external to, the heat exchanger.

Nuclear considerations arise in connection with the coolant water. Normal boiler additives may give trouble due to decomposition under irradiation in the reactor. Therefore, pure demineralised and de-aerated water may have to be used. This can be extremely corrosive at the temperatures and pressures proposed, and stainless steel tubes will be needed in the heat exchanger. Obviously, there is a strong incentive towards finding a suitable additive that will enable mild steel tubes to be used.

Steam Cycles

The next question which has to be decided is the external steam cycle. This has to take account of the fact that the steam is made available in the saturated condition with no superheat. As it expands in the turbine, it will thus become excessively wet. The authors examine five schemes, with the results summarised in Table II. Briefly, they are as follows:

(*a*) Saturated water with steam separation. At an intermediate point in the turbine the wet steam is discharged to an external separator, where moisture removal is accomplished. Steam only 1% wet is then returned to the turbine low pressure cylinder, and is expanded down to 15% wetness at the condenser. The difficulty about this otherwise simple scheme is that there is likely to be a high pressure drop at the moisture separator.

(*b*) Instead of separating the moisture as in (*a*), the wet steam may be reheated at an intermediate pressure. Plant will be complicated, however, by the need to bring high temperature water from the reactor to a second heat exchanger adjacent to the turbine.

(*c*) The idea expressed in (*b*) may be applied using live steam from the main heat exchanger. There will be some loss of efficiency, but plant will be simpler.

(*d*) If the steam temperature in the main exchanger is lowered sufficiently, it is possible to obtain sufficient superheat there to permit expansion throughout the turbine without excessive wetness. This arrangement offers some simplicity but is considered basically wrong thermodynamically.

WATER POWER REACTORS

Problems of Nuclear Power Stations Discussed by I. Mech. E.

(*e*) Finally in this section of their paper the authors consider the use of an external superheater fired with coal or oil. This avoids troubles with wet steam, but site complications are much increased. All the difficulties associated with fuel storage, ash disposal and dust removal reappear. This scheme may be justifiable, however, on favourable sites for the largest units.

Table II indicates that even with the least efficient cycle, over 120 MW electric is available. The size of turbine required may lead to the use of three or four exhausts if a 3,000 r.p.m. speed is chosen. There may be a case for going to a 1,500 r.p.m. machine or for using two machines with each reactor.

An interesting possibility with the external superheater is that of varying the electrical output while keeping the reactor heat output constant. However, this would entail a big variation in the temperature of the steam entering the turbine, and it is doubtful whether the accompanying thermal shock would be acceptable.

In the cycles discussed, the main concern has been to remove the excessive amount of moisture formed because the turbine is fed with saturated steam. It may, however, be possible and preferable to design a turbine with drainage facilities which can operate without external superheating, and without excessive blade erosion.

One-Fluid Cycles

If the water used as the coolant in the reactor can be applied directly to the generation of steam, and then passed through the turbine, the need for an external superheater is eliminated. Moreover, the steam pressure in the boiler drum can approach the pressure inside the reactor vessel. Two possibilities exist. In the first, boiling can be just suppressed inside the reactor vessel, and the hot water allowed to flash-off in an external vessel operating at lower pressure. The second possibility is for boiling to occur in the reactor vessel. In both cases the steam will be radioactive, and so the turbine parts will become contaminated. There should be no difficulty here under normal operating conditions, but if a fuel element fails, liberating fission products into the coolant, there may be considerable difficulty in decontaminating the external circuit.

Thermodynamically, the use of the reactor as the evaporator section of a boiler is the most attractive. The difficulty is that it means providing sufficient space within the reactor core for steam formation without undue loss of reactivity. In this connection it must be remembered that the water is acting not only as coolant but also as moderator—the equivalent of the graphite in the now familiar Calder Hall type of reactor. When the water is replaced by steam, the nuclear reaction is slowed down. This leads to consideration of the flash steam cycle. Assuming the same sort of core as in the pressurised-water reactor, water might leave the reactor vessel at 900 lb/sq in., 532° F. The pressure within the flash vessel is determined by the conflicting requirements that the pressure should be as near as possible to that in the core from the point of view of efficiency, and that on the other hand there should be a reasonable difference to reduce the power needed for circulating pumps for the water. Table III compares some features of possible boiling reactor and flash steam cycles. The choice between water extraction in a separator and an external superheater must be made in each case.

TABLE II.—COMPARISON OF STEAM CYCLES FOR PRESSURISED WATER REACTOR

	Water extraction a	High-pressure water reheater b	Live steam reheater c	Low-pressure superheated steam d	Separately superheated steam e
T.S.V. pressure, lb/sq in. abs	420	420	420	210	380
T.S.V. temperature °F ...	450	450	450	450	900
Reheater inlet pressure lb/sq in. abs	—	100	100	—	—
Reheat temperature °F ...	—	450	400	—	—
Back pressure, lb/sq in. abs	0·75	0·75	0·75	0·75	0·75
Final feed temperature °F...	315	315	315	270	315
Turbo-generator eff. % ...	27·8	27·8	27·3	24·3	32·3
Electrical output MW ...	139	139	137	123	213
Turbine steam rate lb/kWh	13·28	11·65	11·84	13·9	9·04
Exhaust area, sq ft ...	139	139	139	145	167

TABLE III.—CIRCULATION RATIO AND THEORETICAL CYCLE EFFICIENCIES

	Flash cycle		Boiling cycle
Reactor press. lb/sq in.	900	900	900
Flash-vessel press. lb/sq in. ...	500	800	900
Feed temp. °F	330	375	375
Heat from reactor B.Th.U./lb steam	887	834	847
Turbine work B.Th.U./lb steam ...	283	282	287
Theoretical cycle eff. %	30·0	31·7	33·8
Steam flow for 500 MW heat 10^6 lb/hr	1·92	2·04	2·01
Water circulation rate for 500 MW heat lb/sec	5,240	23,100	—

The authors conclude that it is not valid to compare pressurised-water reactors with gas-cooled, or sodium reactors merely on a basis of coolant outlet temperature (usually to the disadvantage of the pressurised-water reactor). With water-cooled reactors, temperatures throughout the core are more nearly uniform than with any other type of reactor. The boiler pressure is determined by the coolant return temperature, and viewed in the light of steam conditions and cycle efficiencies, the pressurised-water reactor seems much more attractive.

The principal merit of the pressurised-water reactor is the prospect it offers of meeting a wide range of power station requirements in a single basic unit.

This discussion has not dealt with the important question of cost of power generation. Assuming uranium to cost £20,000/ton, with £10,000/ton for processed and refabricated replacement uranium, the conventional pressurised water reactor might give electricity at 0·503 d/kWh sent out at 80% load factor, and 0·660 d/kWh at 50% load factor. For the boiling reactor, corresponding costs per unit

are 0·462d. and 0·604d. With an external coal- or oil-fired superheater calculated at an incremental cost of £70 per additional kW of installed capacity, and coal at £4 per ton, corresponding costs per kWh of *extra* power generated would be 0·523d./kWh and 0·606d./kWh.

DISCUSSION

MR R. V. MOORE said that the two major shortcomings of the pressurised-water method were that at high temperatures water was a highly corrosive agent and its attack on uranium metal was violent, and that at atmospheric pressure it boiled at 100° C, the effect of this on the design of the plant being shown by the input to the turbines being low-pressure saturated steam. The heat output of the reactor postulated in the paper seemed inflated. The neutron economy of a practical light-water system did not permit the use of natural uranium as fuel; to achieve this it would be necessary to use heavy water, or D_2O. The adoption of a D_2O reactor as standard would mean that by 1965-70 a D_2O plant of 2,000-3,000 tons per year capacity would be needed, since about one ton of D_2O was required for each megawatt of electrical capacity, and the cost would be between £300 million and £450 million, figures which required careful reflection.

MR D. R. GRIFFITHS emphasised that most of the difficulties associated with pressurised-water reactors, as with most other types, lay in the core design and not the external plant. He gave reasons for believing that the view that boiling reactors would produce power at a lower cost than non-boilers was erroneous.

They felt at Harwell that if a pressurised-water reactor were built in this country it should be coupled to a separate oil-fired superheater, primarily to allow more or less standard turbine plant to be used. They also felt that on present U.K. plant and fuel costs it would pay the C.E.A. to build as large a reactor as was economically possible and to increase the output and cycle efficiency by the addition of a separate superheater.

DR A. B. MCINTOSH outlined some of the metallurgical problems involved in the construction of the reactor and said that to date, corrosion-resistant fuels at the end of a certain resistant corroded catastrophically.

MR R. H. BURDETT said that thermodynamically the separately-fired superheater was attractive, but shortage of power-station sites might force the C.E.A. to place nuclear plants at places where supplies of fossil fuel would be difficult to arrange. Assuming four separately-fired superheater units of the type envisaged in the paper on a site, the combustion heat would amount to 652·8 MW, and at an overall efficiency of 33% the superheater installation would be equivalent to 215 MW of conventional plant so far as coal and ash handling facilities were concerned.

MR T. R. WARREN remarked that as the nuclear power programme developed the supply industry would have to look for more load to keep the plants in full operation at night. There was relatively little pumped storage in England, but a suitable outlet might be found in the large-scale hydrolysis of water for heavy water concentration. The hydrogen produced in this way could be used for steam superheating.

MR G. KENNEDY emphasised that if there were going to be considerable advantages in the pressurised-water reactor compared with other types something must be done to produce designs and operate the plant, so that we could prepare our overseas export programme. At the moment we had the lead in the nuclear field, but unless we gained operating experience of new types we should lose it.

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

Surge Impedances

IN the article on "Long Distance Transmission," which appears on page 705 of your issue of 10th November, it is stated that an average value of surge impedance of a conductor to earth is 15 ohms.

From the context it is clear that Mr Wardrop is intending to refer to the effective footing resistance of a line tower, in which case the tower potential is raised to a value of 750 kV for a discharge curent of 50 kA.

The surge impedance of typical overhead line conductors is of a much higher order (J.I.E.E., 1945, 92 (Part II), p. 39), and it is common practice to use a figure of 400 when evaluating surge impedance loadings of lines.

A. F. Coventry,
W. G. Hawley,
B.I.C.C., LTD., LONDON, W.C.1.

Wholesale Self-Service

AS "Peregrin" rightly comments, "self-service" is an accepted feature of shopping in the United States, and we hope to prove that it can be equally successful here. Fundamentally, there is little difference between retail and wholesale shopping. The distinguishing features of the latter are bulk and credit purchases; and the absence of monetary calculations at the time of purchasing should reduce the "delaying stage" to which "Peregrin" refers to an insignificant length of time.

Customers using the self-service Stores may gain earlier advice on new products, as there is an inevitable time lag between the Representative receiving his sample and his reaching the customers scheduled for the last day of his circuit. Self-service implies self-help, and if as a result of visiting the Stores the customer is reminded of goods needed he will be helped by the consequential avoidance of subsequent delay. Both parties should benefit from this visual reminder.

F. French, Sales Manager,
SLOAN ELECTRICAL CO., LTD.

Ring Main Switchgear

ON page 793 of your issue of 24th November, Mr J. A. Fitzpatrick, in a lecture to the 30th annual joint meeting of the Institution of Engineers-in-Charge and the A.S.E.E., is reported as having said that a modified use of ring main units which has the circuit-breaker and one oil switch in the main feeder circuit and one oil switch in the tee off to the transformer, has found favour in Sweden. Such a statement might be interpreted as implying that it had not found favour in Britain, which would be, at least, misleading.

In fact, the arrangement is being used in a number of places in Britain. Manweb alone has 26 ring main units arranged in this way in operation at 33 kV, and well over 100 in operation at 6·6 and 11 kV.

A paper by Booth and MacLarty on the New H.F. Transmitting Station at Rugby, read before the I.E.E. during November, gave details of yet another place in Britain at which the same arrangement has been applied, as reported in your issue of 10th November, 1955.

P. d'E. Stowell, CHIEF ENGINEER,
MERSEYSIDE AND N. WALES EL. BD.
LIVERPOOL, 3.

Earth Impedance

I READ with great interest Mr Thomas A. Stopford's article on Earthing Tests in your issue of 8th December. Would it not ease the position to apply the M.E.N. system?

It is to be recognised that this system of earthing should be used only in an installation connected to a supply system

in which the neutral conductor is multiple earthed so that the resistance between the neutral and earth is low enough to preclude the possibility of a dangerous rise of potential in the neutral.

This system of earthing as well as the e.l.c.b. system is very common in many parts of Australia where vast rural areas are covered by supply. The consumer's installation can be earthed to the supply authorities' neutral link or bar provided that the opening of the supply authorities' neutral link or bar will not disconnect the earthing conductor from the customer's installation.

Regarding Mr Stopford's other query about increasing the Area Boards' 30 amp fuse to 60 amp where two consumers are supplied from the one cut-out, appears to be bad practice on the part of the Area Board. Surely they could use a two way cut-out. However I, too, like Mr Stopford, would like to have other readers' views on this very important subject.

Arthur Dearden,
MANCHESTER, 11.

* * *

I WOULD like to comment on the letter by Mr Stopford in your issue dated 8th December.

In my opinion Regulation 1005B—12th Edition—clearly defines that an earth electrode which *satisfied certain conditions* could be chosen or installed provided that the earth electrode would permit the passage to earth under fault conditions of the current necessary to blow the fuse or to operate the excess current trip of the circuit-breaker protecting the circuit. A note drew attention to the dangers of increases in earth electrode resistances due to weather conditions.

It is agreed that an earth electrode is usually a water pipe and it *satisfies certain conditions*, which in practice limit its impedance to 1 ohm or less.

The following table shows the maximum permissible possible resistances of water pipes used as electrodes on various circuits in compliance with Regulation 1007(A)—Water Pipe—as given in the 12th Edition.

Circuit	1	2	3	4	5
Fuse Rating (Amp) ...	5	10	15	30	60
Maximum Fault Current (Amp)	15	30	45	90	180
Maximum Permissible resistance of water pipe (ohms) ...	2·66	1·33	·88	·44	·22

Regulation 1007(A) stated that the resistance measured between any two points on the current-carrying portion of the pipe had to be such that the voltage between them cannot exceed 40 V under fault conditions.

In practice circuits such as 1 and 2 would be uncommon and hence I endorse Mr Stopford's suggestion that it has *generally been accepted* that the impedance between the consumer's earth electrode and the general mass of earth should not exceed 1 ohm. However, I cannot accept the contention that it has generally been agreed that this is the full meaning of Regulation 1005B—12th Edition— because the earth fault current loop really had to be checked in order to prove that sufficient fault current will flow to blow the fuse.

Proper checking of this earth current loop would have established the existence of any dubious earth resistances. In some instances for circuits such as I have listed, I would suggest that it might have been necessary to ensure that the water pipe resistances were lower than those as listed due to consideration of the earth fault loop.

Turning now to Regulations 406 in the 13th Edition of the I.E.E. Wiring Regulations, Note 1 states: "In addition it is desirable that the maximum sustained voltage developed between exposed metal required to be earthed and the consumer's earth terminal under fault conditions should not exceed 40 V r.m.s."

I would suggest that if one interprets the earth terminal as being at earth potential in the case of water pipes, the water pipe resistances I have given for typical circuits would now in each case be the desirable maximum possible permissible resistance comprising the total of the water pipe resistance, the resistance of the earthing lead and the resistance of the earth continuity conductor (if any). Once again these resistances may have to be less than calculated due to the earth fault loop impedance.

To sum up, therefore, I consider that in the case of water pipes the 12th Edition specified exactly how they could be used and left the checking of their suitability to the contractor, whereas the 13th Edition specifies how they can be used and their effectiveness checked.

J. V. McCormack,
DEWSBURY, YORKS.

* * *

I WOULD like to reply as briefly as possible to the letter of Mr T. A. Stopford in your issue of 8th December.

It is stated that the resistance between the Supply Authorities buried electrode and the general mass of earth may vary from 0·2 to 5·4 ohms. If the Electricity Board concerned was notified of this, I feel sure they would endeavour to rectify this matter by either installing a more efficient "mass earth" electrode: "fifth wire," or applying for Protective Multiple Earthing—whichever is the most economical. I personally, have always found the Electricity Boards most co-operative, and in any case, they are bound to comply with the Electricity Supply Regulations 1937, Regulation 4, Section (1). It is also reasonable to assume that if the consumer's "mass earth" in that district is efficient at all times, then it should be possible for the Supply Authorities "mass earth" to be similarly efficient.

The responsibility for earthing the consumer's installation rests with the electrical contractor, and in the case stated, if it was not possible to locate and bond across the water-pipe joint giving a resistance of 2·2 ohms, then if there are any doubts of the efficiency of this water pipe as an earth electrode some other means of earthing must be adopted by the contractor. If an earth-leakage circuit-breaker should be required (the Supply Authority's earth being satisfactory) the payment would normally be met by the consumer.

Finally, considering consumer B, whose earth fault loop impedance is stated to be 2·6 ohms, then a phase to earth fault here would permit a current of 92·3 amps to flow which would undoubtedly blow a 30 amp fuse. Even if it is assumed that for some reason the fuse does not blow, there would appear a voltage drop across the water-pipe joint of 2·2 ohms resistance in the order of 203 V; the remaining 37 V dissipating through the mass of earth and the earthed neutral of the supply transformer. I cannot see, therefore, how a reversal of polarity could exist, resulting in medium voltage to consumer, normally operating on low voltage, connected to the remaining two phases of this four wire distribution.

I would mention that I.E.E. Regulation 406 applies to the consumer's installation *only*. An earth-fault loop impedance tester, a suitable earthohmmeter or a suitable double-wound transformer (see Regulations 507, 508 and 509) is necessary to determine whether or not the consumer's earth electrode is efficient.

H. F. Smith,
WARRINGTON, LANCS.

NEW EXTENSIONS AT SHEFFIELD TO INCREASE MANUFACTURE FOR AN EXPANDING MARKET

Permanent Magnet Production

PERMANENT magnets are being increasingly used in all branches of electrical engineering. To a large extent the expansion has arisen from the great improvement in the power of permanent magnets resulting from development of the dispersion hardening types. The high qualities of the new magnet materials make possible their use in many applications where previously electro-magnetism in some form was necessary: and the increased power for unit volume extends their range of use in compact designs.

One of the largest manufacturers of permanent magnets in this country is James Neill and Co. (Sheffield) Ltd., who branched into this field of operation during the 1914-18 war, and now make the wide range of "Eclipse" magnets. Last week we visited their Sheffield works in connection with a twin event: the opening of a modern building to house the magnet department, and the twenty-first anniversary of the permanent magnet chuck as used in production engineering, which the company pioneered.

Magnet manufacture is much concerned with securing the best results from the somewhat expensive raw materials used, and some consideration of these is necessary to an understanding of the processes involved. Magnet steels with proportions of chromium up to 35% were the best available well into the 1930's. Such materials have the advantage that they can in general be annealed and machined, though with increasing difficulty as the proportion of chromium is increased. About that time the so-called "dispersion-hardening" alloys, which are not steel at all, came into use. These contain no carbon, and the iron content is no higher than about 50%. First in the field was Alni, in which aluminium and nickel are the alloying elements. Alnico, which includes cobalt, followed. These alloys are brought to the required state after casting by cooling at a controlled rate after heat treatment. There is no sudden quench as with magnet steels.

This oven is used when magnet assemblies are joined with a plastic compound to give a single magnet component

In 1938, it was discovered that if the cooling process takes place while the magnet is exposed to a magnetic field, magnetic qualities in one direction can be improved at the expense of those in other directions. The resulting range of anisotropic alloys was named Alcomax. Later work by the British Permanent Magnet Association led to advanced alloys of this type with columbium as additional alloying element.

Production

All the magnet materials begin in the foundry. Many of the alloying materials are expensive, and the mixes are weighed out manually under appropriate security conditions. In addition to the main constituents mentioned above, small quantities of further substances may be needed to obtain the best properties. The various components are added in pre-determined order to a basic melt in a 2 kc/s induction furnace of 3 cwt capacity. The melt is teemed into a further crucible and hand-cast. Magnetic steels are prepared in ingot form and then sent away to an associated company for rolling. Other alloys are extremely hard after casting, and can only be worked by grinding. They must, therefore, be cast close to their final shape, and this necessitates extensive pattern making. In particular, it is necessary to provide any fixing holes at this stage, since drilling is impossible, so a considerable amount of coring is necessary. Cores are baked hard in a dielectric heater.

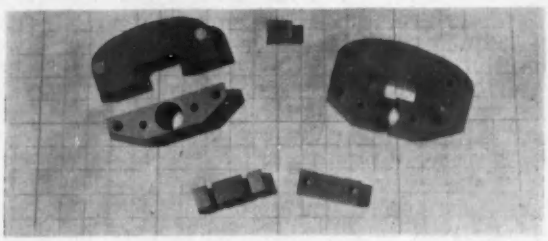
Normal limit for a single magnet casting is 20 lb, although the firm has produced castings up to 30 lb in weight. Larger magnets are made in sections, and assembled in a variety of ways described later in this article. At the other end of the scale, very small magnets are cast in "spray" form, and the common runners broken away before the Wheel-brating process.

From the foundry forward throughout the production chain, all work is palletised, and electric trucks are used for transport. The general flow is upwards, and from the foundry the magnets pass after cleaning in a Wheel-brator

and any necessary fettling to the main grinding shop on the ground floor of the new building.

In the main grinding shop, the magnets are trued on their various faces. Work-study has resulted in extensive jigging for this operation, with women arranging the magnets for the skilled grinders. Next comes a machine shop on the first floor, where final grinding operations are carried out on the advanced alloy blanks, and the usual range of machining operations on the less-hard magnet materials and on mild steel and silicon-iron ancillary components.

After this stage the magnet blanks pass to the heat-treatment shop for the first stage of their specialised magnet processing. A number of gas- and electric-heated furnaces are installed, mostly under automatic control; quenching baths for the steel magnets and magnetisers for the anisotropic magnets are also provided. Heat treatment has the object of increasing internal strain affecting the magnet, and the soak time varies up to 96 hours for some forms of Alcomax. Associated with the directional magnetisers are demagnetisers,, bringing a reminder that for reasons considered later, magnets are normally supplied to customers in demagnetised condition.



Magnets seen here use the adhesive technique described in the text. The greater simplicity of moulding and the use of mild-steel pole pieces is apparent

For most magnets sold to industrial users, there remains after this stage only testing. However, it may be necessary for some designs to build up various parts to give the finished magnet. A recently-developed technique considered promising for this purpose is the use of the hot-setting plastic compound Araldite to stick the sections together. This facility, of course, eases foundry problems where complicated shapes are concerned, and it may facilitate also the assembly of shaped mild-steel components to rectangular magnets.

Another assembly technique of interest is the use of a bismuth compound (Cerromatrix) to fix rotor magnets to a shaft. The shaft is knurled and the inside of the magnet left rough. Expansion of the compound on setting ensures a firm fixing and a high standard of concentricity.

Magnet Testing

Testing magnets falls into three stages. Dimensional inspection; magnetisation and measurement of magnetic properties; and demagnetisation. Work study has led to a marked speeding-up of all these stages. Magnetisation is accomplished by the use of d.c. from metal rectifiers mounted at ceiling height in the machine shop, switching being carried out on the a.c. side. There are several possible methods of testing magnets. Simplest is the use of a fluxmeter with the magnet checked against a standard. Next comes the use of the magnet in a small generator, the voltage wave being displayed on a c.r.o. screen with marked limits. Finally comes the test prescribed by B.S. 406 "Apparatus for Workshop Testing of Permanent Magnets." This involves using the magnet under test to provide flux for a homopolar generator. The magnet is first magnetised to saturation and is then demagnetised. Compensations for length and cross-sectional area can be set in the circuit, and H and B read directly. In some cases only a block cast at the same time as the general mass of magnets is tested in this way: the magnets themselves receive only the brief fluxmeter test.

From what has been said about the production of magnets, it is obvious that the design can greatly influence final cost for a given performance. For this reason James Neill place great stress on the advantages of their being called in for consultation at an early stage by those who may be purchasing magnets in quantity for incorporation in other machines. Quite apart from savings in production costs, the specialised knowledge of the magnet manufacturer may suggest design modifications resulting in important savings. For instance, as a result of deliberations by a number of magnet manufacturers, the weight of the permanent magnet in the track equipment used for automatic train control has been reduced from 22 lb to 9 lb: and similar successes could be quoted.

This article has concentrated on magnets made as components for other firms. The company, of course, produces as well as number of finished products of its own, ranging from simple horse-shoe magnets for use in the home to high-power pot magnets for holding together steel-plate during constructional operations.

Magnetic Chucks

Most famous of the company's products, however, is the magnetic chuck, in which the magnetism can be "switched" on and off by moving the magnet assemblies behind a grid of magnetic and non-magnetic materials. The first prototype was made in 1932: the first production model using 35% cobalt steel was sold in 1935. This latter model gave a pull of 216 lb on a 4½ sq in. test block. With the current model, which uses Alcomax magnets to give improved performance in spite of reduced size, a pull of 622 lb is obtained on the same size test block.

It is pleasant to record that at a dinner held during our visit to mark the coming of age of the chuck, a silver salver was presented as a memento to the present chief engineer of the firm, Mr W. L. Bauer, who invented the magnetic chuck and has developed it since.

Testing in progress, using fluxmeter (foreground), cathode ray oscilloscope, and standard B.S.I. test, rear

From an engineer's notebook

WHEN the electron microscope first made its appearance not so many years ago, there was great rejoicing in scientific circles at this new wonder tool which would open up a new world of what had hitherto been regarded as the sub-microscopic. At that time it was realised that the potentialities of the electron microscope were far greater than those early models suggested. Since then major progress has been made, particularly in providing greater flexibility and what a salesman might call "user convenience." Now we are hearing of the development of some strange and unusual designs in this type of equipment. Firstly, I will refer to an instrument that is said to give greater resolving power by the use of ions instead of electrons and which enables the atoms which constitute the surface of the material under examination to be clearly seen. It is not easy to use since the sample is applied as a coating on fine tungsten wire which is then inserted in a chamber with double thermal insulation, since the examination has to take place at a temperature of some 300°F below zero to secure the necessary definition. Helium is used as a source of ions and the resulting image is shown up on a fluorescent screen in much the normal way. Perhaps a less exciting recent development is that of a mirror electron microscope. In view of the readiness with which electrons can be deflected it is surprising that we have not heard more of this development although its utility may not be so great as that of the conventional type. The design, to which I have seen reference, appears to have a resolving power little better than that of a high power optical microscope although it would seem capable of further development. The real difficulty lies in the interpretation of the results. In addition to displaying the pattern of the surface on the fluorescent screen, the electron beam will be deflected by any irregularity of the potential on the surface of the material so that the actual display will present a nice problem in interpretation, one which will become of increasing complexity as the resolving power of the mirror microscope is stepped up.

* * *

SOME time ago I made a resolution not to write any more notes on the transistor for so rapid were developments being reported that I feared I might provide too much transistor bias. For the past few months I feel I have been behaving myself despite some spectacular achievements in increasing the high frequency range which have taken the experimental stage of transistors away ahead of commercial development. However, there is one development going on to which I feel I must refer. The U.S. Army Signal Corps are said to be working on a miniature radio transmitter which avoids the need for a battery by utilising the input energy of the voice. It would seem that the output of the microphone is split into two circuits, one to provide the necessary energy and the other is fed forward as the signal to the solitary transistor which makes up the set. Tests on the first model have provided satisfactory performance over a distance of 600 ft and although this may not be above the expected capacity of sergeant-majors, it is hoped by the use of higher frequencies and matched aerials that transmission over distances of one mile will be possible. Perhaps even more spectacular is the proposal to develop a companion receiver in which the voice energy will be stored to provide the necessary amplification of the received signal. This will at least set a limit to the amount of listening that one has to do; I wonder if the G.P.O. will be able to adopt some such system?

* * *

WHEN I wrote last month of the use of an electrified fence for caterpillars, I confess I visualised this as the lowest form of life to which electrical control had been applied. I am indebted to Mr A. F. Canham for outcapping my story for he has written telling me of an electric fence (if that is the right word) for aphides. This apparently has been used by a horticultural research station for confining green fly to plants during the study of virus problems. The construction of the fence appears to be not dissimilar from that used for caterpillars, a potential of six volts being used. Presumably this technique could only be used during the non-winged phase of the aphides life, otherwise I might feel tempted to fit electrical fences round some of my choicest plants.

* * *

THOSE of us who have been mostly associated with the power side of electricity are apt to look askance at telephone engineering and while we may exhibit a healthy respect for such fearsome sounding objects as the co-axial cable, the usual run of telephone work may seem little more than a complex form of bell wiring. It is only too easy to overlook the severe duty that telephone equipment has to withstand and, as readers of these Notes will know, the by-ways of telephone research lead to many exciting investigations into the microscopic. Just such an example is a recent study that has been made into arcing phenomena on contacts on extremely small gaps. It has been found that two distinct types of arc occur which have been termed anode and cathode arcs respectively. At voltages of 300 or below either type occurred on the palladium contacts that were used, but as the voltage was raised to 400 V and above, the arcing became wholly of the cathode type. The erosion of the contacts was likewise different. With anode arcs, the main transfer of metal was from the anode which became pitted in consequence. The main interest of the investigation, however, lies in the wear due to cathode arcs, which occurs mainly on the cathode itself. This arc erosion, it was found, followed slight scratch marks on the polished surface, and greatly accentuated them. On closer study under an electron microscope these marks showed up as a series of pits each overlapping the next, in all suggestive of an arc moving intermittently along the line of the scratch. The lack of differentation of these two types of arc may have accounted for some of the difficulties with erosion measurement in the past and when full details become available a better assessment of results may be possible—*E.R.G.*

Protective Equipment for Electrical Systems

PART 2—A REVIEW OF THE DEVELOPMENT OF PROTECTION TECHNIQUES AND APPARATUS

By W. CASSON, M.I.E.E., *Head of Transmission Design Engineering Branch of the Chief Engineer's Department, C.E.A.*

BACK-UP protection consisting of three induction type over-current relays has been successfully used for 25 years and still is the "full-back" for circuit protection; but on transmission circuits where unit protection is employed there is much to be said for distance protection back-up to obtain faster clearance with more certain discrimination. Time graded earth fault relays operating from the residual circuit of the feeder c.t.'s have been used with success in many cases as they have an advantage over relays connected in the phases in being independent of load conditions as far as setting is concerned.

Transformer-Feeders

Combinations of either distance or overcurrent relays at the sending end with directional relays at the receiving end; or unit protection for the feeder with directional relays at the receiving end have been used for many years with satisfactory results. In these schemes supplementary protection is provided on the transformer in the form of restricted earth fault protection on both sides, Buchholz protectors and sustained l.v. earth fault protection. The use of directional relays is confined to those stations in which there is no infeed from the l.v. system which is supplied by the transformer-feeders.

Distance protection, when employed at the sending end, will clear phase-phase faults on the l.v. side and overall protection on the transformers is unnecessary.

In order to trip a transformer-feeder at the receiving end, where the h.v. windings of the transformer are delta connected, neutral point displacement protection has been used to deal with the broken conductor type of fault. Trouble was experienced with early equipments which were unreliable owing to a variety of causes.

Operating Conditions for Circuit Protection

Both unit and non-unit protection schemes on the transmission system have been difficult to design to operate satisfactorily on the low values of fault current at one end of a circuit which can arise during certain conditions of operation of the Grid. Fault currents under these conditions are likely to be just above full load value and in extreme conditions below. Starting and fault detection relays have had to be employed to ensure that they operate under these internal fault conditions without responding under normal load conditions.

Certain types of unit protection, employing summation transformers are less satisfactory than other types under broken conductor fault conditions but none is completely satisfactory and here there is scope for improvement in design. In the case of phase comparison carrier current protection for example, the use of three signalling channels so as to compare each phase separately would give the needed improvement though it might not be economic.

Transformer Protection

Designers of transformer protection have given much attention to the production of a scheme using a single relay that will protect against all types of fault. This has been found to be a very difficult task for not only has a transformer an in-rush current phenomenon akin to a fault condition but it often has a ratio variable over a wide range and the difficulties are aggravated when two or more transformers are banked. In France fast operating overall protection has been abandoned, but in this country several schemes have been successfully developed and are in common use. A recent development in some of these schemes has been to apply harmonic restraint making use of the fact that the magnetising in-rush currents contain harmonics which are not present to any appreciable extent under transformer fault conditions. The application of these harmonic restraint schemes is almost entirely confined to large units and for small units simpler schemes are employed. Even with overall protection some supplementary protection is usually supplied, e.g. Buchholz and overload and additional earth fault protection if the neutral point is not solidly earthed.

The alternative to overall protection and supplementary protection is overcurrent and restricted earth fault protection on each side with Buchholz protectors, winding temperature protectors and standby earth fault protection. The combination of overcurrent and restricted earth fault protection has the ability to clear earth faults rapidly but other types of faults not so rapidly, lack of discrimination at times being accepted.

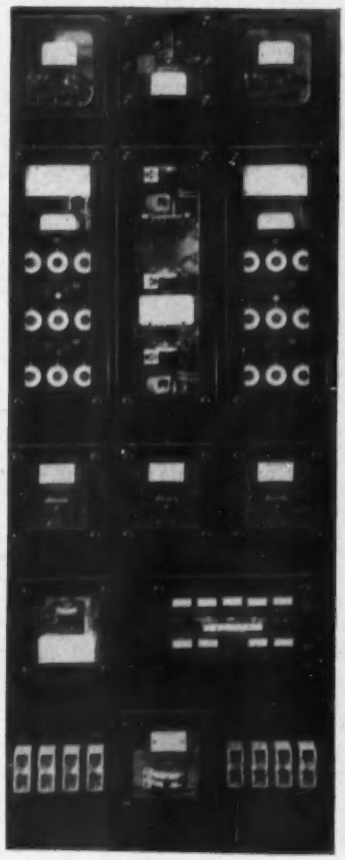


Fig. 3a. Installation of phase and earth fault distance protection with relays in separate cases

The C.E.B. adopted this arrangement for the first Grid transformers and it has served very well. Some trouble with instability of restricted earth fault protection was experienced under magnetising current in-rush conditions and on external faults, but this was effectively cured by introducing stabilising resistors. Some shutdowns were caused by the non-discriminative operation of overcurrent relays on internal phase-to-phase faults clear of earth on exposed transformer connections, and although such faults were infrequent the confusing relay operations prevented supply from being restored until the cause of the fault had been established. In some cases in recent years the separate overcurrent relays in the phases on each side of the transformer have been replaced or supplemented by a "rough balance" overall scheme using three overcurrent relays. With this arrangement discrimination on phase faults can be obtained, the operating time on internal faults can be as low as 0·5 second and a back-up overcurrent characteristic for external faults is provided.

Standby earth fault protection was a later addition and was provided to protect the short time-rated earthing transformers and resistors against sustained earth faults.

Buchholz protectors were first installed in the 1930's and have amply justified their application although there have been minor troubles such as inadvertent operation when the transformer forced cooling pumps are started and stopped, and when abnormally low temperatures caused the oil level to fall below the Buchholz operating level.

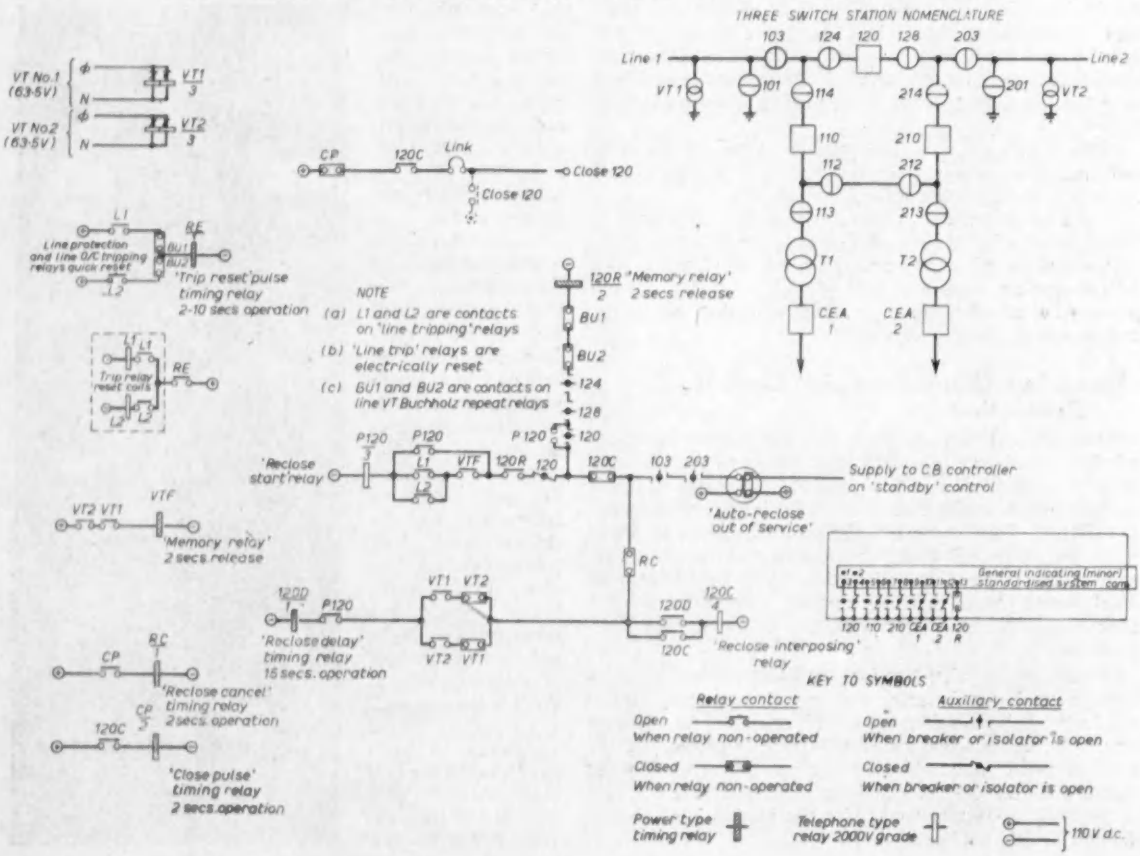
When transformers are banked there is much to be said in favour of separate protection for each transformer—for which purpose current transformers are required in the transformer bushings—and separate protection for the connections between the transformers and the common circuit-breaker. However, the arrangement which has been adopted for the 275/132 kV auto-transformers when these are banked is a simple overall Merz-Price scheme for the banked system.

Tank leakage protection for earth faults was developed in this country over 30 years ago but has not been widely used, presumably because it only protects the transformer and not the connections. In France it is now employed to protect large units leaving the connections to be protected by over-current relays. It is being employed for indication purposes on the 275/132 kV auto-transformers in this country. Although precautionary measures have to be taken in applying this form of protection it has the advantage of being independent of system conditions and consequently can be made as sensitive as possible consistent with the transformer capacitance current to earth.

System planning requires the loading of transformers up to the thermal limit and this has caused more attention to be given in recent years to the need for indication of transformer temperature, the detection of hot spots, and tripping when prescribed limits of temperature have been exceeded; but much remains to be investigated in this field. From a protection point of view it is not only the transformer itself that must be considered in this respect, but also its associated switchgear and connections.

With transformers intertripping is a requirement which can be very complicated on occasions owing to considerations such as the availability of tripping battery supplies and whether the circuit to be protected consists of one or more than one transformer separated by a considerable distance. Care has to be taken to protect the wiring associated with the

Arrangement for three switch station with delayed automatic reclosing (dead line charging) of section switch



protective device installed at or on the transformer against deterioration by exposure to oil and condensation, factors which can result in the tripping of a healthy transformer.

With the earliest forms of tap-change mechanisms, when tap-changing was effected by means of split transformer windings or of bridging resistors, it was usual to provide unbalanced current protection with the former and thermal protection with the latter, both of which tripped the transformer if the tapping switch failed to complete an operation once begun. Although some modern transformers employ bridging resistors for tap-changing, improved mechanisms render the risk of an incomplete operation so remote that thermal protection for the resistors can be dispensed with.

Auxiliary transformers solidly connected to the main transformers are normally included in the protected zone of the main transformer and usually a Buchholz protector is fitted. The l.v. side of the auxiliary transformer is usually protected by fuses and it is essential that these should be as close to the transformer as possible as a sustained fault on the l.v. windings could lead to serious trouble.

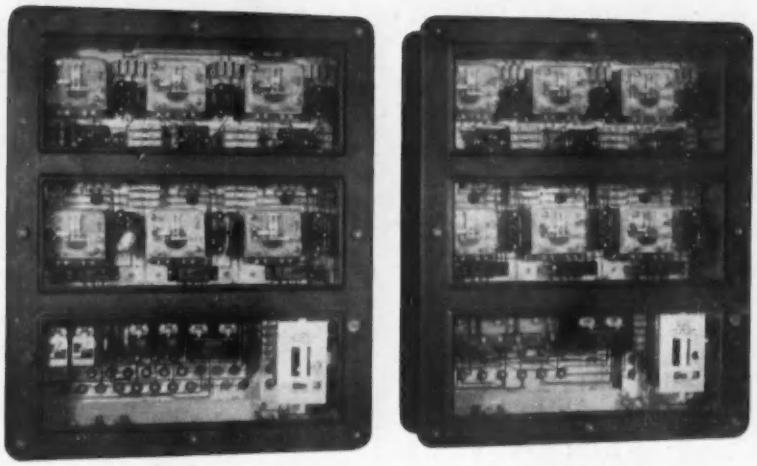


Fig. 3b. Installation of distance projection with phase fault relays and earth fault relays respectively arranged in two groups, each in a large case

Generator Protection

Practically all generators 20 years ago were directly connected to the busbars and unit transformers were not teed off the generator terminals. Compared with that of modern generating units the protection of these generators was simple, consisting of Merz-Price circulating current protection together with overcurrent relays or reverse power relays. As the systems were usually resistance earthed this Merz-Price circulating current protection was required to be stable under through phase fault conditions producing transient values of some 12 times full load current, and to be as sensitive as possible in order to cover as much of the windings as possible on internal earth faults. This protection gave very satisfactory results but was not able to clear interturn faults free of earth. Reverse power relays were used to protect against motoring, but in many cases were found to be unstable on through faults and were either removed from service or rearranged to be effective only during a synchronising operation.

The addition of the directly coupled main transformer and teed off unit transformer increased considerably the amount of protection to be provided. In some cases a separate set of c.ts. was installed between the generator connections and transformer terminals to enable separate units of protection to be applied to the main transformer, unit transformer and generator; but the standard arrangement now is to omit the c.ts. between the generator and main transformer and to provide overall differential protection of the combined main transformer and generator for phase-to-phase faults and, for the generator windings and connections, main transformer l.v. windings and unit transformer h.v. windings separate earth fault protection in the form of two earth fault relays operating from a current transformer in the generator neutral, one an instantaneous relay with a 10% setting. and the other an induction relay with a 5% setting and with a suitable time setting designed to avoid operation by unbalanced capacitance currents during system faults.

The introduction of the main transformer enabled an easement to be obtained in the performance requirements, stability and sensitivity, of the overall protection compared with the Merz-Price schemes on directly connected generators, by virtue of the separate protection for earth faults and the need for the overall protection to deal only with phase faults. The unit transformers in the standard arrangement have a separate overall Merz-Price scheme together with a two stage h.v. overcurrent relay, one relay clearing the l.v. switch for a sustained l.v. fault and the other tripping the generator for a fault on the l.v. switch.

Table 1 gives a list of the items in the protection required for a direct connected generator without a unit transformer and a transformer connected generator with unit transformer. It will be seen from this Table how ramified the protection of a modern generator has become.

Phase unbalance protection was introduced about 25 years ago and has become more important with the development of hydrogen cooled generators. None of the phase unbalance protection schemes which have been installed to date satisfactorily match the negative phase sequence capability characteristics of the generators protected; but two British manufacturers have now developed improved versions which show promise of fully meeting the requirements.

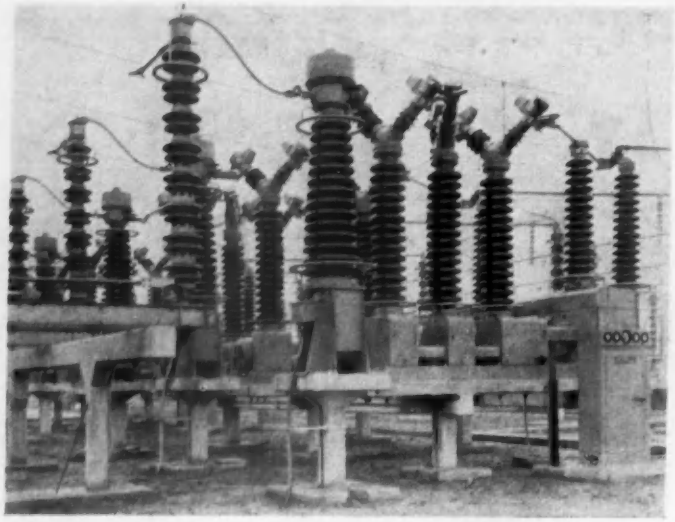
It is normal practice in this country to provide for h.v. back-up purposes an induction type overcurrent relay provided with a high setting to avoid inadvertent operation on a normal external fault.

With the larger machines there will probably be little departure from the technique now adopted for sets up to and including 60MW, but some duplication of protection may be justified and care in the layout and protection of the wiring involved will be necessary.

At the last C.I.G.R.E. Session a scheme was put forward by a U.S. delegate for simplifying generator protection by omitting the conventional Merz-Price overall protection and replacing it by a three-element directional relay. Although this scheme is attractive it did not receive much support in the discussion on the Paper, the general feeling being against the use of a single relay to give full protection, it being better to have separate protection units for each of the various items of plant in the interest of quick location of a fault.

(To be continued. Part I was published on Dec. 15.)

EQUIPMENT AT THE NEWLY OPENED 275 kV SITE



Drakelow Switching Station

THE Drakelow 275 kV switching station will ultimately be one of the biggest in the United Kingdom, covering an area of more than 54,000 square yards, and controlling 14 circuits. Seven of the circuits are already installed.

The station is of the low double busbar type, the busbars being of 3 in. diameter rigid copper tube carried by the isolator and by intermediate post insulators. The isolators and post insulators are mounted on reinforced concrete pedestal structures to give the necessary ground clearance to the busbars, while the circuit connections are in the form of flexible conductor, crossing above and at right angles to the busbars and strained between reinforced concrete A frames. Riser connectors from the busbar selector isolators and down-dropper connectors to the circuit-breaker and its associated equipment complete the circuit connections.

At present the main and reserve busbars are each single section, with a busbar coupler circuit-breaker provided between them, but ultimately the main busbar will be divided into three sections with busbar section and busbar coupler circuit-breakers. Circuit-breaker by-pass isolators are not provided but there are facilities to by-pass a circuit-breaker by flexible conductor loops and to isolate it by removing connector sections. The circuit can then be controlled by the busbar coupler circuit-breaker and extended maintenance of the circuit-breaker undertaken, if required, with the circuit still in commission.

Circuit-Breakers and Isolators

The circuit-breakers are Reyrolle Type 2750B30, of the air-blast design, 1,200 amps maximum current rating and 7,500 MVA making and breaking capacity, and are mounted on reinforced concrete pedestal supports to give the necessary clearance from live metal to ground to avoid the need for safety screenwork. They are similar to those described in our article on the Elstree switching station, published in our issue of 6th October.

The isolators are of the General Electric Company's manufacture, to a standard design developed for the Authority, and are of the double rotating, two-post design, with a special ball and socket type of high pressure contact. They are all provided with power operation mechanism and the busbar selector isolators are arranged in tandem while the three phases of the circuit isolators are ganged side by side.

Only the busbar selector isolators are arranged for remote operation from the control room, but they are all fully interlocked with the circuit-breakers to prevent their operation unless the appropriate circuit-breaker is open.

Transformers

The current transformers, of Reyrolle manufacture, are of the post type mounted independently of the circuit-breaker. The primary conductor is of "U" formation, fully insulated for the system voltage with condenser grading layers and a metal earth screen. The cores and secondary windings are of the orthodox continuous ring type mounted in a steel chamber over the bottom section of the "U" primary, the top end of which is contained in a single porcelain insulator surmounted by a metal connection chamber. The whole assembly is vacuum dried and oil filled using condenser type oil, and the top chamber is provided with a nitrogen sealing device with a breather incorporated. Four or five independent secondary windings are provided for instrumentation and protection services, with suitable tappings and test windings to give the maximum facility for interchangeability and for site testing.

Voltage transformers are also of Reyrolle manufacture and are of the capacitor type; these are more compact than the electromagnetic type and have a high impulse strength. The actual transformer core and winding assembly are relatively small since the transformer is designed for operating at a much lower voltage than the line voltage, and is coupled to the line by means of a capacity divider which is incorporated in the construction and is connected between line and earth. The condenser section between the transformer primary h.v. winding and the line is contained in two separate oil-filled porcelain housings mounted above the earthed metal chamber which accommodates the transformer, and the condenser is connected between the h.v. winding and earth, i.e., in parallel with the h.v. winding. The metal chamber is filled with oil, but has two air-filled sections with access covers in which are accommodated the spark-gap device and the secondary terminals and fuses.

POWER SUPPLY

Statistics for November

NOVEMBER proved to be a good month for power supply, recording a high total of new plant commissioned, and showing all round increases in sales of electricity. The new plant comprised three 60 MW sets and six boilers, of which five are in the over 500 klb/hr rating class.

First on the list comes Brighton B power station (South Eastern Division), which now has eight boilers steaming with the commissioning last month of a further 320/klb/hr unit. Like the earlier seven, it is of Babcock and Wilcox manufacture. In the neighbouring Southern Division, the station featured in our "Building a Power Station" series, Marchwood, sees the first of its boilers—of 550 klb/hr rating and by John Thompson—and the first of its 60 MW sets is likely to follow soon. Further north, Drakelow A (East Midlands) sees its fourth boiler. This is a 515 klb/hr International Combustion unit. As foreshadowed last month, Meaford B (Midlands) records its first set, following the commissioning in October of its first boiler. The turbo-alternator is of 60 MW rating, and made by B.T.H.

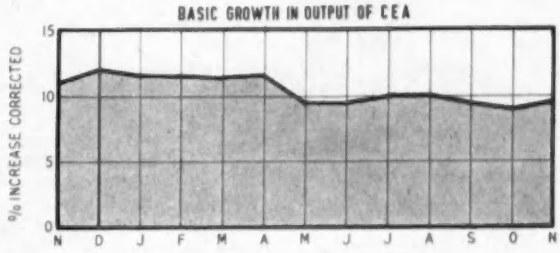
South Wales Division's generating capacity is augmented by 60 MW following the commissioning of a further G.E.C. turbo-alternator in Uskmouth A. This is the fifth set for the station, which now only requires one more for completion. Just to the north of the principality, a 550 klb/hr boiler was commissioned at Ince (North West, Merseyside and North Wales). Like its two predecessors, it is an International Combustion unit. On the opposite side of the country, the Yorkshire Division station, Keadby, sees its sixth boiler, a 550 klb/hr Stirling unit which is likely to be followed shortly by its sixth, and final, set. As suggested last month, the second 60 MW set at Stella North (North Eastern) has now been commissioned, this being a Parsons machine. The companion station, Stella South, records its third 550 klb/hr International Combustion boiler.

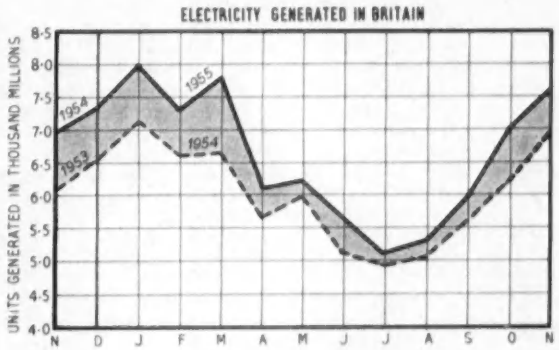
As mentioned earlier, all round sales increases were recorded for the month, over November last year. Figures range from a modest 5% for the North Western Board, to 13·5% for the South Eastern Board, the total increase recorded by the C.E.A. being 8·7%. Temperatures, however, were a little higher this year than last during the month, and the effect on sales was such that the basic growth in load amounted to 9·5%.

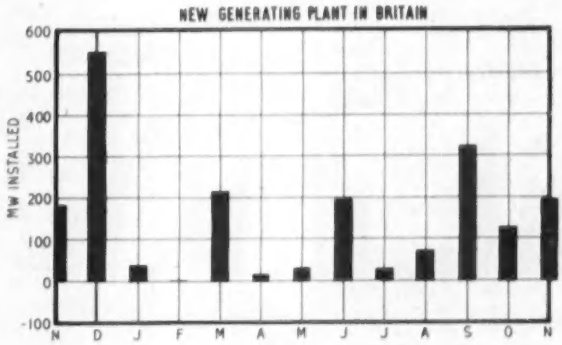
In all, some 7,589 million units were generated during November, 7,485 millions by steam, and 87 millions by water power. The proportion generated in hydro-stations is 60·8% less than that for November last year, as has been the case since the summer as a result of the shortage of rain. Of the grand total, 6,967 million units were generated by the C.E.A., and 118 millions and 504 millions by the North and South Scotland Boards respectively.

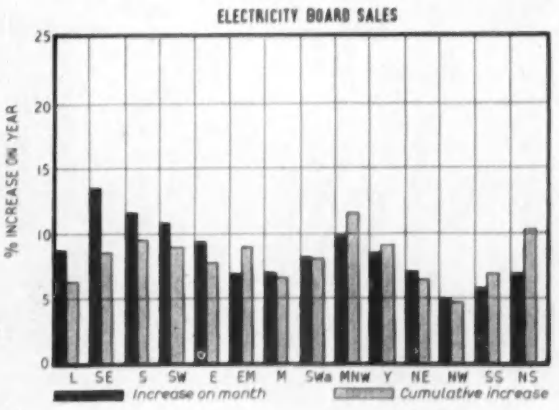
SALES BY ELECTRICITY BOARDS IN NOVEMBER

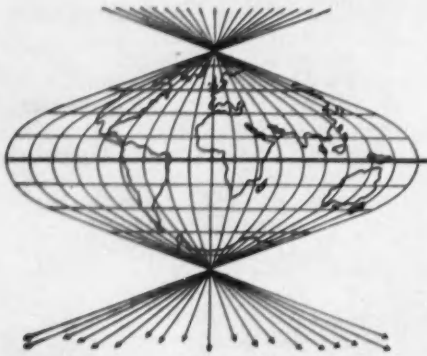
Electricity Board	Electricity sold million units	%age inc. on Nov. 1954
London	643·1	8·8
South Eastern	384·1	13·5
Southern	466·5	11·6
South Western	238·4	10·9
Eastern	620·4	9·5
East Midlands	532·6	6·9
Midlands	707·5	7·0
South Wales	396·0	8·2
Merseyside and North Wales ...	412·3	9·9
Yorkshire	691·0	8·5
North Eastern	393·1	7·1
North Western	737·6	5·0
Direct Sales by C.E.A.	159·0	17·0
C.E.A. Grand Total	6,381·6	8·7
South of Scotland	516·0	5·7
North of Scotland	114·5	6·8











OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Manitoba-Ontario Link

Officials of the Manitoba Hydro-Electric Board and the Hydro-Electric Power Commission of Ontario have agreed to the linking of their power systems. The power pool now being formed in Manitoba by the city-province agreement will be hooked to the big north west Ontario power system, perhaps as early as the fall of 1956. The stability of the 650,000 kW Manitoba power system would be increased by the addition of reserve power from the 300,000 kW system in north west Ontario. A joint committee of engineers is now trying to work out a plan for early interconnection. If some snags cannot be overcome, it may not be made until 1958. A power-sale agreement is also being worked out between the two Provinces. The Manitoba Board already has a high voltage line into Kenora, and the Ontario Commission is now building a line from Dryden to Kenora.

Blaming Manufacturers

Manufacturers are to blame for the slow growth of the Canadian electrical appliance industry in the opinion of Mr R. M. Keyes, vice-president of General Motors, U.S.A. In Toronto recently when launching Frigidaire's 1956 programme, he said the appliance industry was guilty of not making enough progress product wise. Following investigations, his firm were convinced it was not fair for the husband to have a new car if the wife did not get a new kitchen. The only reason she did not get a new kitchen was because she did not want it, which was a poor reflection on the manufacturer.

Alberta Expansion

The Calgary Power Co. has two hydro-electric plants on tributaries on the Bow River which are almost completed. Known as the Pocaterra and Interlakes stations, these provide an additional 25,400 h.p. to the company's existing capacity of 270,000 h.p. A steam station is under construction at Wabamun, 40 miles west of Edmonton, where the first 88,000 h.p. unit should be in operation next year. This station may be extended to an ultimate capacity of around 500,000 h.p., for the company serves an area in which considerable development is taking place. At the moment the company serves over 66,000 consumers in addition to supplying in bulk to two cities and three towns where there are approximately 60,000 consumers. The average annual domestic consumption last year, by the way, was 1,835 units.

U.S.A.

Nuclear Plan

Initial financing plans for a proposed commercial nuclear power plant in New England, U.S.A., have been approved by the Securities and Exchange Commission. Subject to approval by the Atomic Energy Commission, the plant will be built and operated by Yankee Atomic Electric Co., in which 12 private power concerns are associated. The company expects to negotiate a contract with the Atomic Energy Commission which will provide a small degree of financial assistance towards the estimated total cost of $33·4 millions of the project.

NORWAY

Aluminium Expansion

The Industrial Affairs Committee of the Norwegian Parliament has approved plans for increasing aluminium production at the State-owned Ardal plant, West Norway, by 36,000 tons to altogether 60,000 tons a year. The cost, including the development of hydro-electric power, is estimated at £19,700,000, and a United States loan of $20m is envisaged to meet part of the cost. The State-owned concern A/S Ardal also propose to raise the production capacity of its Sunndal plant by 10,000 tons to 50,000 tons as soon as additional electric power is available—probably within the next five years.

HOLLAND

Using Windmills

With the idea of trying to save many of the windmills in Holland an experiment is being tried at Hasselt, near Zwolle. The old windmill there was in danger of falling into disuse because its method of grinding corn was considered uneconomic. The local electricity board decided to try and save the windmill and on the initiative of Mr R. Baggerman, chief engineer, plans were drawn up for its conversion to generate electricity. This conversion work has now been completed, a 30 kW generator having been installed, at a total estimated cost of 10,000 guilders (about £1,000). It is hoped that between 30,000 and 50,000 units will be generated annually, for feeding into the Grid. The conversion cost may seem high, but Mr Baggerman considered that it may be reckoned a small price to pay in the long run to keep the familiar Dutch windmill in service. Whereas there were about 6,000 windmills in Holland at the beginning of this century, there are now only 1,200 still standing, of which about 800 are in regular use. The aim is to prevent the loss of any more. In the experimental conversion at Hasselt, a weather vane sets an electrical mechanism for turning the sails into the wind, a further device regulating the amount of surface area according to the strength of the wind. The result of the experiment will be watched with considerable interest in many countries.

EGYPT

Aswan Dam Finance

It has been announced that the British and American Governments have decided to provide aid to Egypt to build the High Aswan dam. It is stated that the British contribution will be $14 millions, and the American share $56 millions. It is believed that these moves presage a favourable decision by the World Bank in providing finance for the work.

S.W. ASIA

Funds for Koyna

India is negotiating with the World Bank for a loan for financing the construction of the Koyna hydro-electric scheme in Bombay State, Mr Jaisukhlal, the deputy planning minister, has stated. The Koyna scheme, on which much of the preliminary work has been done, is to have an installed capacity of 240 MW in the first stage, with a further 180 MW planned in the second stage. The area lies in a heavy rainfall zone, catching 150 to 250 inches a year. It is proposed to utilise a drop of about 1,500 ft between the bed of the Koyna River and the western foot of the Ghats. The proposed dam will be about 208 ft high and 2,200 ft long, the spillway being located in the central portion. The catchment area is about 345 sq miles and capacity of the

reservoir at full level is expected to be 2¼ million acre ft at the final stage—in the first stage it will be about 0·83 million acre ft. The power station itself will be built underground about 800 ft below ground level at the locality; making it the first real underground power station in the country. It will involve the construction of a cavern 55 ft by 350 ft in the first stage, extending to 550 ft ultimately. Transmission will be at 220 kV. Irrigation is proposed to be introduced in the second stage of the project.

Disappointed Undertakings

With India's Second Five-Year Plan visualising an investment of about Rs. 50 crores by company electricity supply undertakings, the Federation of Electricity Undertakings of India emphasises that the situation demands that appropriate incentives should be offered to the investor. At the moment the rate of return is limited to 5% under the Act, and although as the result of pressure over a long period the Central Government are proposing to increase that figure to 5½%, the Federation has urged that the rate be raised to 6%. The Federation have already been disappointed by the rejection of the Industry's request for provision in the Electricity Amendment Bill for a reserve to meet deferred taxation liability, while the "ungenerous" terms hedging the proposals regarding a new development reserve are considered unsatisfactory.

Further Participation

Canada has now agreed to participate in the construction of a 132 kV double circuit transmission line between Dacca and Chittagong, Pakistan. The new line provides for connecting Chittagong with Sidhirganj steam power station, but when the Karnafuli hydro-electric scheme comes into operation the line will be available for the supply of power in the reverse direction. The president of a firm of Canadian consulting engineers has been in East Pakistan during the past weeks discussing details of the project with Mr W. C. Patton, chief engineer, electricity, and engineers of the East Pakistan Government. The Canadian Government has agreed to provide the electrical equipment and material required for the project and has also agreed to provide engineering services, including the supervision of designs and drawings, the supervision of installation and provision of assistance to the Pakistan engineering authorities in the preparation of foundation and installation specifications. The estimated cost of this equipment and these services is $4m (approximately Rs. 20m).

AUSTRALIA

Nuclear Training

Intent on keeping abreast of nuclear power developments the New South Wales State Government has decided to send a team of engineers to England to train as nuclear engineers. The men are to train with one of Britain's manufacturing groups. This action follows the recent recommendation of Mr V. Brain, chairman of the N.S.W. Electricity Authority. Mr Brain suggested that the power supply industry should not immediately involve itself in the construction of costly plant, but should get experience from plants being constructed in Britain.

New Concern

A new company just registered in Melbourne with a capital of £A500,000 is Siemens Schuckert Australasia Pty., in which one third of the capital is each held by Siemens, of Germany; Wykeham and Co., of London; and Mr J. W. Maddieson, of Melbourne. The new concern is to continue as an agency for the time being, we understand, but later will provide an assembly business and subsequently manufacture equipment not already made in Australia.

Development Expenditure

Loans totalling £1,473,350 are to be made by the Electricity Commission of Queensland to four regional electricity boards. The money will be spent on electrical development during the current financial year. The allocations are: Wide Bay - Burnett, £277,000; Capricornia, £336,000; Townsville, £512,350 and Cairns, £348,000.

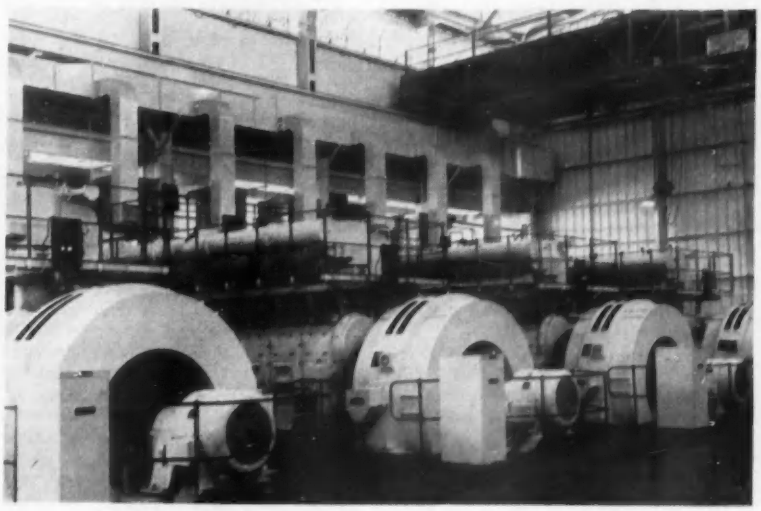
NEW ZEALAND

Date for Roxburgh

Contractors engaged on the Roxburgh hydro-electric scheme, in South Island, are now confident that power from the station will be available by 15 June next, the target date for stage 6 which stipulates that the dam shall be finished to the point where the lake can be built up and Nos. 1 and 2 turbines can go into operation. Thus, the project will be 7½ months ahead of the schedule laid down in the contract. The men employed on the work will get a substantial bonus if the target date is attained. The bonus is the remainder of pooled funds that have been banked for the men for each month they bettered the target placement of 22,000 yards of concrete. This is drawn on to pay a weekly bonus each month the target is reached. Placement each month has not fallen below 22,000 yards since Nov. of last year. This bonus system was instituted by the contractors, who will recoup the money from the Ministry of Works under a clause of the contract. Roxburgh is the largest single hydro-electric project yet attempted in New Zealand. The dam will be 190 ft high, and 1,400 ft long, across the Clutha River. It has been designed for an ultimate capacity of 320 MW, but orders have not yet been placed for all the machines, although there has been agitation that these should be arranged.

Objection to Scheme

At a recent meeting of the Taupo Borough Council, New Zealand, an objection was received from 82 ratepayers to the council's proposed application for sanction of a loan of £105,000 for a second hydro-electric power scheme on the Hinemaia River above Hatepe. The ratepayers want further particulars of the project and discussions with the council.



Bahrain, in the Persian Gulf, now rich in potentialities as a market for many types of goods as a result of oil production developments in recent years, is rapidly progressing electrically also. Earlier this year H.H. the Ruler of Bahrain formally inaugurated a new power station in which British equipment is installed. The interior of this Manamah "B" power station is illustrated alongside, showing the four 1,000 kW sets, comprising National prime movers driving Brush alternators. Now running on oil fuel, these machines are in process of being converted to operate on natural gas. Contructors of the plant were D. and C. and William Press Ltd., who are now engaged on the l.t. distribution network on the island, including house services and street lighting. The number of consumers served is rapidly increasing —the figure is over 10,000—the supply system being a.c. 230 V. Obviously there is a good market in Bahrain for British domestic appliances, particularly reliable, low-priced refrigerators we understand

Personalities

IN THE INDUSTRY

Enfield Cables Ltd. announce the appointment of **Mr J. Morgan Blades** as their resident engineer in Canada. Mr Blades, who takes up his appointment on 23 Dec., will be located in Montreal. For the last six years he has been with the Hydro-Electric Power Commission of Ontario.

It is also announced that **Mr W. E. Gardner,** B.ENG., has been appointed managing director of Enfield Cables (Australia) Pty., Ltd., as from 3 Dec. Mr Gardner has spent all his life in the Cable Industry and for many years was associated with Siemens (Australia) Pty., Ltd.

The London branch of the University of Birmingham Guild of Graduates has elected **Major E. H. W. Banner,** T.D., M.SC., M.I.E.E., M.I.MECH.E., F.INST.P., M.CONS.E., as chairman for the present session, with **Mr H. G. Foster** as vice-chairman.

Mr L. H. Finedon, formerly commercial sales manager of Remploy Ltd., the Government subsidised company which operates ninety factories for the severely disabled, has been appointed sales director. This appointment was made following suggestions put forward in the recent report of the Organisation and Methods Division of the Treasury. Mr Finedon, joined Remploy Ltd. in Sept. 1953, from Morphy-Richards Ltd., where he was home sales executive. During the war years he held a directorship of that company and was manager of their Contracts Department.

Tube Investments announces the appointment of **Dr T. P. Hughes,** M.A., PH.D., as director of the Tube Investments Research Laboratories at Hinxton Hall, Cambridge. **Dr F. P. Bowden,** F.R.S., is the chief research consultant to Tube Investments Ltd. Dr Hughes was head of the Chemistry Department and subsequently chief superintendent of the Rocket Propulsion Department of the Royal Aircraft Establishment before joining Tube Investments Ltd.

Mr G. H. Martin and **Mr L. F. Odell** have joined the board of Metropolitan Relays Ltd. and its associate companies.

On her retirement recently for domestic reasons, **Miss P. Wiskar,** demonstrator at Beccles, to the Eastern Electricity Board, was presented with a tea-making machine and a cheque from her colleagues by **Mr J. H. Shepherd,** A.M.I.E.E., the Board's district manager. Miss Wiskar, who was with the East Anglian Electric Supply Co., Ltd. before nationalisation, had been a demonstrator in the electrical industry for 21 years. In her long career she had worked in several East Anglian towns, including Halesworth, Fakenham and Downham Market, before going to Beccles.

Appointed as chairman of the Isle of Man Electricity Board is **Sir Joseph D. Qualtrough,** C.B.E., Speaker of the House of Keys. He succeeds **Mr J. R. Corrin,** who has retired, as we recently reported. Sir Joseph has been a member of the Electricity Board for some years. His place will be taken by **Sir Ralph Stevenson.**

The E.A.W. Diploma in Electrical Housecraft has been awarded to **Miss Sylvia E. Wilson** (S. Western Electricity Board, Exeter); **Mrs Constance M. Roper** and **Miss Betty H. Whiteside,** both of the N. Western Electricity Board, Blackburn. Mrs Roper and Miss Whiteside gained first class passes in all three subjects and distinction in cookery demonstration. Miss Wilson gained first class passes in cookery demonstration and salesmanship.

The Distington Engineering Co., Ltd. (branch of the United Steel Companies Ltd.) announce that **Mr T. S. Kilpatrick** will relinquish his duties as commercial manager of Distington Engineering Co., Ltd. on his appointment as deputy general manager of the Workington Iron and Steel Co. on 1 Jan., 1956. He will remain a director of the Distington Co. On the same date, **Mr A. E. Bell,** sales manager (engineering) is appointed general sales manager and **Mr T. Wintrup,** contracts manager, will become sales manager (engineering).

The resignation of **Sir Edward C. Bullard,** S.C.D., F.R.S., from the directorship of the National Physical Laboratory takes effect on 31 Dec. next. The appointment of his successor will be announced in due course. In the meantime, and pending the taking up of office by a new director, the Lord President of the Council has appointed **Dr R. L. Smith-Rose,** C.B.E., D.SC., M.I.E.E., at present director of radio research in the D.S.I.R., to be acting director of the N.P.L. from 1 Jan. next. Dr Smith-Rose has been director of radio research since Jan. 1948, having been superintendent there for twelve years. He is very well known for his extensive investigations in radio direction finding, the electrical properties of soil and sea-water, and the propagation of radio waves over the ground and through the lower atmosphere. He was chairman of the I.E.E. Radio Section in 1943, and was president of the Institute of Radio Engineers, New York, in 1948.

Works director of Hall and Pickles Ltd., **Mr J. H. Russell,** has been appointed deputy managing director, and **Mr F. R. Robbins,** general sales manager, has been appointed sales director.

Mr R. K. Deane has been appointed production controller of R. B. Pullin and Co., Ltd.

Mr R. H. R. McGill is joining the board of Balfour Beatty and Co., Ltd., as an executive director on 1 Jan., and as a consequence he is relinquishing his partnership in E. F. Turner and Sons at the end of the year.

Mr A. J. Shrosbery has now been elected chairman of T. Clarke and Co., Ltd. Mr G. A. Robinson has been elected to the board.

Mr A. Rigby, B.SC.(ENG.), A.M.I.E.E., vice-principal of the Colchester and North East Essex Technical College, retired last week after 31 years of teaching in Colchester. He joined the Technical School at Colchester as senior master in 1924, and was appointed head of the Applied Science Department of the Technical College in 1948. Last year he became vice-principal of the new Colchester and North-East Essex Technical College. He is the chief examiner for technical drawing for the Cambridge University General Certificate Examination.

The Highway and Street Services Committee of Croydon Corporation have placed on record their high appreciation of the work of **Mr F. N. Rendell-Baker,** M.I.E.E., who, since retiring in 1948 from the position of chief engineer and general manager of the Corporation's electricity undertaking, has acted as adviser and consultant on matters relating to street lighting. As from 1 Jan., **Mr A. F. Holt,** A.M.INST.C.E., the borough engineer of Croydon, takes over responsibility for street lighting on behalf of the Corporation.

Directors of all the Lancashire Dynamo group of companies, together with senior executives from the works and sales offices throughout the country are to attend a dinner today, 22 Dec., to mark the occasion of the retirement of **Mr H. W. Bosworth** as chairman. Mr Bosworth, who began his career in 1904 at the Lancashire Dynamo, Trafford Park Works, will have completed more than 51 years service. Opportunity will also be provided at this private function for the guests to meet **Mr S. F. Steward,**

C.B.E., on his appointment as managing director of Lancashire Dynamo Holdings Ltd.

OBITUARY

Mr J. A. Steeples, secretary of the Leicester sub-area of the East Midlands Electricity Board, died on 9 Dec. aged 57. He began his career with the Leicester Corporation Tramways and Electricity Department in 1911 and with about 44 years service, was one of the longest-serving employees on the East Midlands Electricity Board. After rising to the position of chief wages clerk, he was appointed assistant secretary of the Leicester sub-area in 1940, and took over the secretaryship in 1954.

Mr H. V. Pointon, managing director of Asea Electric Ltd., died on 14 Dec., aged 59. Before returning to this country early in 1949 to assume the managing directorship, Mr Pointon was general manager and chief engineer for the company in India, Pakistan, Burma, Ceylon and Malaya. In all, he spent 24 years in the East, during which time he was connected with many important power development schemes. He had also been a J.P. and an hon. presiding magistrate for Greater Bombay. A past chairman of the Junior Institution of Engineers, Mr Pointon received his early training with the Metropolitan Electric Supply Co., Ltd., joining the present company, then known as the Swedish General Electric, in 1920.

Lt-Col. W. C. Peebles, D.S.O., T.D., D.L., who died on 14 Dec. aged 84, was the eldest son of the late Mr D. Bruce Peebles, founder of the firm of Bruce Peebles and Co., Ltd. Educated at Edinburgh Institution he received engineering training at the Baldwin Locomotive Works in Philadelphia. He joined his father at the Hay Works, Edinburgh, in 1891, at which time the company was manufacturing gas governors and gas engines. In 1896 he was made a partner and with his brother, the late Mr Arthur C. Peebles, was largely responsible for the development of the electrical side of the business. But in 1908 the two sides separated with the formation of Peebles and Co., Hay Works, and Bruce Peebles and Co., East Pilton, since when Col Peebles had been associated with the gas side of the works.

Mr E. F. Foster, M.INST.F., for many years a senior sales representative in the U.K. to George Kent Ltd., died on 9 Dec., aged 56.

Mr J. Y. Broughton, generation engineer (operation) for the Western group of power stations in the London Division of the Central Electricity Authority, died on 14 Dec., aged 59. Prior to his appointment as generation engineer, he was superintendent of the Fulham power station from 1950 to 1953. Mr Broughton was educated at Marlborough School and served in the Forces during the 1914-18 war. He was trained with the North Metropolitan Electric Power Supply Co., and served as steam plant testing engineer before going to Fulham in 1926.

NEW LITERATURE

Transistors: Theory and Application

by A. Coblenz and H. L. Owens

THE seven years public life of the transistor has witnessed the growth of a separate technology denoted to solid state devices, which is admirably reflected in this compact and comprehensive exposition. Its emphasis throughout is practical, the theoretical account being correspondingly related, although this treatment does not detract from its overall usefulness. For the electronics engineer, here is presented a succinct account of virtually all that needs to be known about transistors to employ them in practical circuits. One of its highlights is a discussion of those aspects of transistor manufacture which bear on transistor characteristics and applications.

It opens with a short history of transistors, leading to an introduction, in general terms, to transistor physics giving an approximate explanation of transistor action. Having thus cleared the decks, so to speak, the author now attacks the subject from a more fundamental viewpoint, starting from an elementary discussion of quantum mechanics, which is then developed into a consideration of the electron from both its corpuscular and wave packet concepts, and this leads logically to considering the nature of semiconductors themselves. The physics of point and junction transistors are then discussed separately as a prelude to transistor electronics, and the behaviour of transistors in circuits. Several chapters are given over to this aspect, dealing with small-signal parameters, earthed-emitter and earthed collector connections, transistor switching circuits and transistor cascading. Concluding sections discuss manufacturing processes, silicon (preceding chapters having dealt almost exclusively with germanium) and a number of special topics. Published by McGraw-Hill, 313 pages, 9 in. by 6 in. Price 42s. 6d.

Analysis of Feedback Control Systems

by R. A. Bruns and R. M. Saunders

AS with transistors, automatic control has developed its own individual technology. Whereas those actively engaged in this work have been able to keep abreast of such development, however, the individual now entering this field can be faced with the time-consuming and frustrating task of endeavouring to assimilate the variety of approaches of the past. To overcome the difficulty, this book is designed as a collection and an evaluation of previous literature to present a unified method of analysis which aims at being consistent with the technological background of the average graduate engineer entering this field. To this end the emphasis is on the understanding of basic methods of analysis to develop a suitable background from which the reader can approach the study of synthesis techniques. No previous experience in this subject is expected of the reader, but familiarity with a.c. steady-state circuit theory, fundamental laws of dynamics, and elementary differential equations are pre-requisites.

After an introductory survey, the book is divided sensibly into two sections—dealing with components and feedback system theory. The first deals with mechanical systems, electric actuators, hydraulic, pneumatic and electric circuit elements, electronic, magnetic and dynamo-electric amplifiers, transducers and reference standards, creating a valuable understanding of the components of closed loops control systems, before discussing theory in the second section. This opens by considering specifications and stability of systems, and the techniques of block diagrams and network reduction, experimental methods for obtaining transfer functions then follow, leading to a discussion of the derivation of transient response from frequency response data. Chapters on non-linear and discontinuous systems conclude the book. Published by McGraw-Hill, 383 pages, 9 in. by 6 in. Price 53s. 6d.

BOOKS RECEIVED

The Year's Photography 1955. Selection from all exhibitions held in 1954 under the Royal Photographic Society's auspices, together with reviews of artistic photography, scientific photography and its application, and of the nature exhibition. Published by Royal Photographic Society of Great Britain, 16 Princes Gate, Kensington, S.W.7., 82 plates, 18 pages, 9¼ in. by 7¼ in. Price 10s. 6d. (Also in paper covers, 7s. 6d.)

Pressure Die Casting. British Productivity Council Review 23, this booklet surveys productivity in the pressure die casting industry, detailing steps taken by the industry to increase its own productivity. Published by the British Productivity Council, 21 Tothill St, S.W.1, 30 pages, 8¼ in. by 5¼ in. Price 2s. 6d.

Der Transistor by J. Dosse. In German, it provides an up to date account of transistor theory and development, and includes coloured illustrations of magnifications of typical transistors. Published by R. Oldenbourg Verlag G.m.b.h., 109 pages, 8¼ in. by 5¼ in. Price 11·80 D. Mark.

Applied Electricity by Prof. D. H. Cotton. New edition, containing additional chapter on the analogy between electric, magnetic and dielectric circuits, together with numerous minor improvements throughout. Fourth edition, published by Cleaver-Hume, 496 pages, 8¼ in. by 5¼ in. Price 20s.

Quinn's Electrical Engineering, Radio and Television Diary, 1956, contains 92 pages of technical information which includes lighting and cable data, and notes on motors, insulation, heating and refrigeration. Published by H. O. Quinn Ltd., 151 Fleet St, E.C.4, 5¼ in. by 3¼ in. Price 5s. 6d. and 4s. 3d.

Equipment for Industry

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Shaft Mounted Reduction Gears

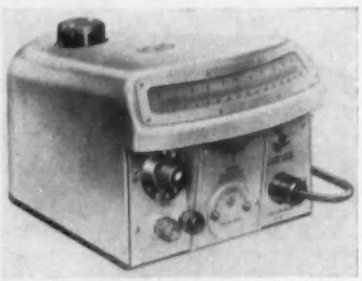
SUPPLEMENTING their recently-introduced range of shaft-mounted speed reducers, J. H. FENNER CO., LTD., Marfleet, Hull, now offer two larger units, sizes 5 and 6, providing a fixed speed ratio of 15:1 for drives up to 30 h.p. The four previous models have found an increasing popularity in industries requiring reduction drives for conveyor belt systems and similar slow moving mechanisms. The two new units have been introduced to cater for larger installations which may require the advantage of compact design and simple installation offered by these reducer gears. Once mounted on the output shaft, only one external fixture is required. This takes the form of an adjustable torque bar fixed at one end to the gear housing and at the other to a rigid framework or wall. In this manner the complete unit is prevented from rotating about the shaft.

In some drive systems it has been found necessary to incorporate a back stop to prevent accidental reversal of rotation. This may occur with inclined conveyors on power failure and should the load run back the operators could be placed in a dangerous position. With the Fenner designed torque-arm speed reducer, the back stop may be quickly installed and consists of an outer race containing multiple sprags which are retained by compression springs to make contact with the extended end of the reducer input shaft. When the shaft turns in one direction the sprags slip, but if the direction of rotation is reversed, each sprag tilts and locks between the outer race and the input shaft.

The speed reduction gear can be seen mounted on the driving shaft and securely anchored by the adjustable torque-arm bar

Robust Laboratory Voltmeter

DESIGNED as a laboratory instrument, the "Scalamp" d.c. voltmeter has a claimed accuracy comparable to the more elaborate valve operated type. With a relatively low cost and offering advantages of negligible drift and freedom from spurious effects caused by mains variations, this meter produced by W. G. PYE CO., LTD., Newmarket Rd, Cambridge, has an input resistance of 1 megohm per volt. The sensitivity of this instrument relies on a taut suspension galvanometer movement producing a high input resistance even on the lower voltage ranges. This arrangement is said to provide an improved efficiency and accuracy compared with the pivoted coil systems usually employed.

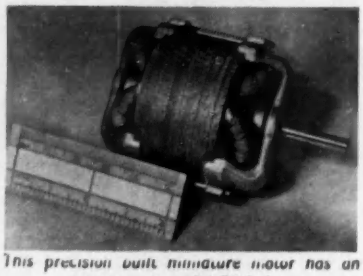


Pye's new d.c. voltmeter caters for 0·01 to 300 V in ten ranges

A transformer for use on a.c. mains 200/250 V has been incorporated and a 2-pin safety plug recessed into the front panel permits connection. For portable use or in situations lacking a suitable mains supply, removal of a shorting bar enables the instrument to operate from a 4 V battery. This low voltage supply is utilised only for illuminating the optical indicating system on the front panel. The moving light-spot scale has been divided into two sets of 100 and 150 units both 15 cm long. Mounted on three flexible rubber feet, the complete instrument has been housed in a sealed case containing a desiccator to ensure stability of the high resistance components. In addition, the galvanometer unit has been designed to reduce the necessity of critical levelling before operation.

Miniature Servo Motors

SERVO-MECHANISM designers requiring a suitable driving motor will find a recently-introduced squirrel cage motor worthy of consideration. Weighing only 8 oz. and measuring 3 in. by 2 in., the single-phase, precision-built miniature motor by JONES AND STEVENS LTD., Long Lane, Littlemore, Oxford, has an output rating of 1/70th h.p. with a nominal speed of 2,700 r.p.m. A number of versions of this motor are available for a wide range of supply voltages and frequencies although the general model operates from 240/120 V, 50 c/s. Terminal connections are outside the motor housing to permit an easy changeover to either of the two voltages. The motors have extended shaft lengths of ¼ in., which have been found suitable to accommodate most drive couplings associated with mechanisms powered by miniature motors of this type.



This precision built miniature motor has an output rating of 1/70th h.p.

Corrosion Protection for Equipment

THE expansion of an American company manufacturing "Hypalon" will enable this synthetic rubber compound to be available in larger quantities for the English market. Distributed in this country by DURHAM RAW MATERIALS LTD., Great Tower St, E.C.3, the compound may be brushed or sprayed on to practically any material to form a protective coating which remains flexible at high and low temperatures. Although primarily intended to insulate industrial equipment against atmospheric or chemical corrosion, "Hypalon" may also be employed to cover floor tiles since the substance shows a high resistance to scuffing and abrasion.

Installing Wiring on Trays

IT has been found that the perforated metal tray system provides an economic and versatile method of cable installation compared with the more familiar wall bracket system. A company specialising in perforated metals, LOCKERS LTD., Warrington, Yorks, have introduced their Durite cable tray range consisting of standard 8 ft long trays varying in width from 2 in. to 36 in. Bends and "T" junctions are included with ceiling brackets and cross members. The supports have been drilled at standard centres to accommodate various lengths of cable droppers or bracket widths. Once the trays and brackets have been installed, the cables are placed in the metal runs and clipped into position, the clips passing over the cable and through suitable holes in the perforated metal. This system obviously lends itself to rapid installation and ease of wiring maintenance. The cable fixing trays and bends produced by this company are available in a variety of finishes and special designs or trays of a particular metal may be requested.

For the Electrical Trade

B.N.E. market Metalform Timer—C90 Cooker Improvements

A SLIGHTLY restyled and modified version of the original Metalform Auto-timer control unit is to be marketed by BRITISH NATIONAL ELECTRICS LTD., Newarthill, Motherwell, under their own name and selling at £7. 10s.

The remarkable growth of interest in special time control panels shown by housewives has prompted B.N.E. to prove to them that time control is not something that can be enjoyed only with the most expensive model cookers beyond the reach of many under modern hire purchase restrictions.

All new production from Metalform will, we understand, be marketed by British National Electrics Slight rearrangement, a different tone in colour and the B.N.E. symbol mark the new units.

The C90 cooker, in addition, has been modified on all new models. Similar controls will be available as optional extras for all plates and larger, easier to read control dials of 2 in. diameter will be fitted on the cooker control panels.

Vactric market Two Washboilers

TWO new washboilers mark the entry of VACTRIC LTD., 196 Sloane St, S.W.1, into the home laundry market.

Large model is the Vactric V.77, a simple yet pleasing design in white vitreous enamel with black bakelite and aluminium alloy reliefs.

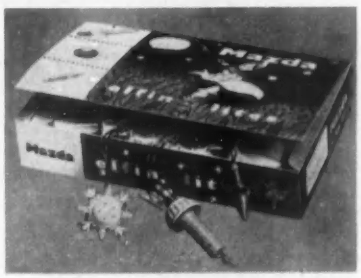
Total capacity of the copper boiling pan is 10 gallons of water but normal load is 7 lb clothes in 7 gallons of water.

A three-heat switch controls the six 500 W elements with integral reflector plates riveted to the pan bottom. Dimensions are 30 in. x 18½ in. x 22 in. closed and the price £24. 17s. 3d. including tax. This price is for the complete boiler, which includes a 10 in. Acme hand-operated wringer of the latest pattern. Optional extra is the hand agitator which costs £1. 16s. 3d. inc. p. tax. This has a knuckle joint in the handle which can be folded back for fitting the cover plate.

Second model is the V.45 Junior wash boiler which is similar in appearance and in electrical equipment but smaller in dimensions—30¼ in. x 16¼ in. x 20¼ in. No wringer is fitted to this model but it has a removable table top providing extra kitchen space. Operating capacity is 7 gallons of water, and the cost £13. 19s. 6d. complete, free of purchase tax.

"Elfin Lites" from B.T.H.

DECORATIVE lighting set particularly appropriate to the present season is made up from Mazda lamps under the name "Elfin Lites." The set comprises four "Fairy" lights, four "Fairy Candle" lights, and four "Snow Gem" lights, brightly coloured plastic spheres surrounded by a frost pattern. The lamps are wired in series by a green flex that should be effectively disguised around a Christmas tree or twined with holly, and are provided with clips at several points. There is an attractive coloured box that can serve as a counter display, and which stresses the "Elfin" rather than the Christmas theme. The set is suitable for 200/260 volts. The price is £1. 10s. 9d., plus 6s. 10d. purchase tax. From Mazda Lamps and Lighting, BRITISH THOMSON-HOUSTON CO., LTD., Crown Hse, Aldwych, W.C.2.



"Elfin Lites" are appropriate to Christmas

New "Easiclene" heated Washer

A LARGE 2·7 kW heating element fitted in the tub is principal new feature of the model E.W.4 fresh from the factories of EASICLENE PORCELAIN ENAMEL (1938) LTD., Darlaston, South Staffs.

The new model outwardly resembles the already well-known E.W.1 with the exception of three fool-proof switches situated on the front skirt. These are on circuit with an automatic cut-out so that should the water in the bowl boil dry the element is automatically switched out and all controls trip out until the element has cooled down.

The element is situated just under the agitator and is easily accessible by merely removing the agitator. Dimensions are 16 in. x 16 in. x 28 in. Washing capacity is 4½–5 lb and the price (list) £33. 2s. 7d. plus £13. 14s. 8d. p. tax.

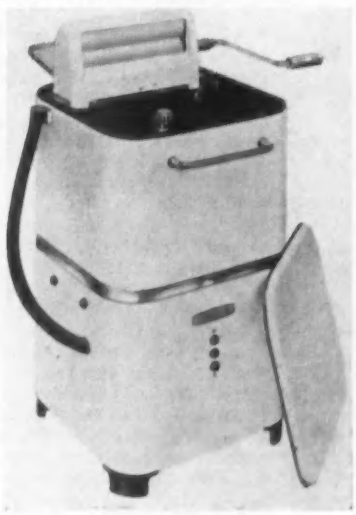
Vactric's V77 washboiler is on the left with views of Easiclene's EW4 heated washing machine

Acru Heavy Duty Soldering Iron

PRODUCTION of an extra heavy duty soldering iron is announced by the ACRU ELECTRIC TOOL MFG. CO., LTD., Chapel St, Stockport Rd, Levenshulme, Manchester 19, who say that the design is in answer to the need for a tool to handle the soldering of heavier gauges of sheet metal wire, etc., that has hitherto been possible with electric irons.

Feature of this model is the large area of element approx. 11¼ sq in. which, say Acru, ensures a longer life than usual.

A choice of three easily interchangeable copper bits, i.e. pointed, hatchet or chisel. Loading of the element is 450 W, maximum heat is within 5 mins and weight of the iron approximately 8 lb. Price of the iron fitted with 5 ft of cable and pointed bit as standard is £5. 10s. whilst interchangeable bits and spare parts are available as extras.



PROBLEMS AND PRACTICE

In Engineering

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Shocking Water Tap

YOUR correspondent "Ubique" (1 Dec. issue) condemns his own workmanship. He describes the circumstances resulting in the waste pipe of a bathroom basin becoming alive, and mentions in passing that he had been previously responsible for the installation of an immersion heater in the same premises. The condition he describes could not arise if an earth continuity conductor had been installed in accordance with the I.E.E. Regulations since this would have bonded the water taps to the waste pipe.

Whilst it must be agreed that where there are no appliances in the bathroom, the installation of the continuity conductor is "nobody's responsibility," in the present instance "Ubique" admits to having installed an immersion heater, which created a danger of the hot water system becoming alive. It was his responsibility to install the conductor at the same time.—*P. J. Baldwin.*

Temporary Metering

IT is sometimes required that a heavy current a.c. circuit has to be temporarily metered for a period of time which may be too long to permit such a useful instrument as a portable c.t. to be used with convenience. To this end it is possible to press into service old and discarded current transformers in the following arrangement which gives accurate metering even with trip-on types.

Three current transformers are required, each of the same ratio. One of them is connected to supply the instruments for temporary metering in the usual way (ammeter, and other meter current coils in series), except that this secondary circuit also includes, in series, a resistor whose ohmic value is equal to the combined resistances of the instruments, connecting leads and the c.t. secondary winding. The other two transformers are then connected in series on their primary sides with the first so that they each carry the load current. Their secondary windings are connected in parallel across the resistance in the first circuit so that the current they produce is in opposition to that being measured.

The effect of this arrangement is that by virtue of the value of the resistance, the current flowing through it will be the same as that in the measuring circuit but in the reverse direction. The reverse voltage drop across this resistance then cancels that appearing across the instruments and secondary winding so that the transformer operates with a burden of effectively zero impedance. In this condition, the c.t. errors are small, even if the primary has low amp-turns. The resistance required may be readily adjusted to its correct value by a d.c. millivolt drop test; taking care that as small a current as possible is used in the c.t. secondary winding. —*A. M. P.*

Rotor Short-Circuit

A VARIABLE speed induction motor developed a short-circuit on the rotor when running at full speed with the result that it became impossible to reduce its speed to the required value using the controller, although when started with all the controller resistance in circuit, the normal slow speed was obtained. This suggested that the short-circuit was due to centrifugal force causing the faulty rotor coils to lift.

As the rotor open circuit voltage was approximately equal to the stator voltage, it was decided to disconnect the supply from the stator and apply it to the rotor sliprings, at the same time connecting the controller resistance across the stator winding. The machine was then run up to speed on no load for a few minutes, and subsequent inspection then located the faulty coil, which had become hot. On removing the tape from the coil in question, a short-circuit between turns was discovered.—*C. K.*

Brush Puzzle

A COMPOUND wound, vertical, drip-proof motor (16 h.p., 220 V, d.c.) was designed to drive a geared pump delivering forced lubricating oil to a marine diesel engine. Both motor and starter were of foreign make, the latter not being fitted with an ammeter.

Trouble was first encountered when the motor was found to be running hot, and on inspection it was found that the armature was burnt out, with obvious signs of overload. On replacing the repaired armature, the motor was run up to speed and the current noted on an ammeter inserted temporarily in circuit. Some 40 A were flowing with no-load on the pump, which increased to 85-90 A when load was applied, when the overload protection operated.

The motor was then suspended clear of the pump and run up to speed, the current being approximately 5 A. The pump was immediately suspected of being troublesome. Although quite free to turn by hand, possibly it was not so when running at normal speed.

At the same time that the pump was opened for inspection, the motor was stripped again, the field coils and connections checked for continuity and polarity, and the armature drop tested. Everything was found satisfactory.

The motor and pump were reassembled and run up to speed. The current was still 40 A on no-load and increased as load was applied to the value of 90 A when again the overload protection operated. The brush gear position, which was on the maker's mark and had not been altered, was then moved, reducing the no-load current to 7 A, and the normal load current to 44 A.

The cause of trouble had thus been found in the most unlikely place. There still remain one unsolved mystery—why had not the motor given trouble earlier? It must be added that the brush could not have moved by any means, which makes one ask, had somebody corrected the position at an earlier date?—*G. Cox.*

Important Grub Screw

IT is unusual to find such commonplace items as grub screws featuring in a leading role in electrical equipment but a recent experience with a generator proved otherwise. The man in charge of the plant (a 30 kW d.c. machine for an estate) reported severe flashing-over and sparking to be taking place continually at the ctmmunicator.

An inspection showed that heavy sparking was occurring even though the machine was on a light load. The set was shut down, and an inspection of the commutator showed that bad joints at the back of the lugs was the trouble, no fewer than six well-pitted micas being seen. With a screwdriver, the leads to the commutator were easily lifted up at these places, and all were clean breaks.

From experience it was realised that slackness somewhere must be causing these breaks, either a slack core on the shaft; or a slack commutator, and nothing could be done on site. Inspection at the repair shop showed "bleeding" between cone and shaft, proving a slack fit. Removal of the shaft was one of the easiest jobs yet—on removing the grub screw in the collar at the commutator end, the shaft was pushed out by a gentle tap with the hand. Neither the shaft nor keys had apparently been a fit and all that was keeping the cone from moving about on the shaft was the $\frac{1}{4}$ in. grub screw. All the keys showed signs of chafing. Fortunately, the winder was able to make a satisfactory repair to the commutator leads after a new shaft had been fitted.— *A. L.*

NEWS OF THE WEEK

Large Domestic Appliance Attraction planned for Electrical Section of B.I.F.

ARRANGEMENTS for the electrical section of next year's B.I.F. are going well, if slightly behind schedule. Over 100 exhibitors have now booked space and the ground floor of Olympia's Grand Hall is almost full. Latest move on the part of the organisers is a campaign to attract manufacturers of domestic appliances. Although plans are still being debated, we understand that special arrangements are being made to have a large-scale domestic appliance feature in the gallery. This is to include an extensive theatre for demonstrations of cooking, laundry and other equipment. Electrical trade and supply organisations have been approached, and in a luncheon speech last week, Mr Kenneth Horne, managing director of B.I.F. Ltd., mentioned that the London Electricity Board had been asked to take part, and, we understand, to organise the demonstration feature. An increase in the number of domestic appliance exhibitors is the immediate aim of the section organisers. Of the present 100 or more manufacturers who are participating, about 25 are particularly concerned with the domestic market, and the object is to raise that number considerably. Initial negotiations are still in progress and an announcement giving details of the B.I.F.'s domestic electrical appliance feature is expected early in the New Year.

Contractors' Holidays-with-Pay-Stamp Rates raised

AS from the week commencing 2 Jan. next, the value of the weekly holiday credit stamps under the Holidays-with-Pay Scheme in the Electrical Contracting Industry is being raised from 6s. 6d. to 7s. 3d. in respect of journeymen and from 5s. 6d. to 6s. for all adult mates. This is the result of the agreement entered into by the National Federated Electrical Association last May. The present stamps can be exchanged for the new denominations by forwarding them to Specialist Trades Holiday Scheme Ltd., 14 Bedford Row, London, W.C.1.

ENORMOUS DEMAND FOR POLE HOLE BORER

MANUFACTURE and world selling rights of Taymen Ltd.'s Horn-draulic pole hole borer have been handed over to Steel Fabrications (Cardiff) Ltd., Roath, Cardiff. This decision has been taken to cope with the huge demand for this machine over the past few months from customers both at home and overseas. Export enquiries should be addressed to Steel Fabricators (Overseas) Ltd., 7 Chesterfield Gardens, London, W.1.

Two Subsidiaries taken over by Charles Colston

A FRESH development in the organisation of the newly formed Charles Colston Ltd., was announced last week. The £500,000 company formed last March by Sir Charles Colston to produce labour-saving domestic appliances has now acquired the assets of two light engineering works. They are Tallent (Aycliffe) Ltd., general engineers in Co. Durham, and Smith-Richards Ltd., jig and fixture makers at High Wycombe, Bucks. Both companies are to continue with their normal production, but large-scale programmes of expansion are in hand which will eventually double existing factory space, and work will then be altered where necessary to suit the requirements of the new controlling company. The subsidiary companies were chosen for two main reasons. In the first place, they provide first-class engineers and craftsmen, and, in addition, the factories are fully equipped with modern plant.

Mr J. P. Ford, recently appointed managing director of Charles Colston Ltd., has been appointed chairman of the two subsidiaries. There is still no news on what exactly the new company intend to market, but it is expected that they will be in production in the latter half of next year.

Site fixed in Torquay for B.E.P.C. Exhibition

SITING of the exhibition to be held in conjunction with the 1956 British Electrical Power Convention, has now been settled. As previously announced, the Convention will take place at Torquay between 23 and 29 May. Torquay Council has agreed that the exhibition be situated at Torre Abbey Meadows, which is an excellent site on the main promenade between the Belgrave and Grand Hotels. It had been suggested earlier that the Shedden Hill car park be used for the exhibition, which is to be housed in a marquee. The last time the Convention visited Torquay, the exhibition was held in the Grey Cars garage in Torwood St.

Once again the B.E.P.C. Council have invited E.D.A. to arrange the exhibition. The Association state that, as in former years, a limited amount of space will be available for electrical manufacturers who are not identified with any of the participating organisations. They suggest early application for space to the Secretary of E.D.A., at 2 Savoy Hill, W.C.2.

EDINBURGH IS PLANNING CATERING EXHIBITION

A CATERING Exhibition is being planned by the Health Committee of Edinburgh Corporation and the Catering Trades Association in Scotland. It will be held in the Assembly Rooms (George St) betweeen 27 Oct. and 3 Nov. next year. Main objective is to promote clean catering. A preliminary plan drawn up for the exhibition allows space for some 50 displays as well as for a cinema, a meeting room, and cookery demonstrations. Stand space is to be let at 7s. per sq ft. Closing date for applications has been given as 31 Jan.

BRANCH A.G.M.

ANNUAL meeting of the Hants and Dorset branch of E.I.B.A. will take place at Central Electricity Hse., in High St, Portsmouth, on 24 Jan., at 5 p.m.

Electrical Courses in South London

WE note two courses of lectures to be staged shortly by the Dept. of Electrical Engineering and Applied Physics of S.E. London Technical College. The first starts on 10 Jan., and will be given by six lecturers on Tuesday evenings on Transmission System Protection. The syllabus comprises: principles, development of types, fault calculations; transformer and generator protection; pilot wire protective systems; carrier current protection; distant protection; and general considerations, testing and maintenance. The second course, also of six lectures, will be by E. A. Reeves on Calculations of Symmetrical and Unsymmetrical Short Circuits. It begins on 21 Feb. Syllabus in this case includes the theory of symmetrical components; ohmic percentage and per unit methods of considering R.X. and Z.; examples of symmetrical and unsymmetrical short circuits; and general discussion. Fee in each case is 10s., and applications should be addressed to C. W. Robsen, head of the Dept. at the College, Lewisham, S.E.4.

Big Choice for Tenants on Bentley Housing Estate

TENANTS in the 52 new council houses being built at Bentley near Doncaster will undoubtedly have all the freedom of choice between gas and electricity which any householder could wish for. In addition to having power points in every room, they will also have five gas points. Many of the points are of course designed to provide the same service. At their meeting last week, the urban council agreed to accept an offer from the Gas Board of free installation of service pipes. In return they undertook to install a minimum of five gas points. The cost of the extra gas points will be £105, but there will be a saving of nearly £400 on this agreement.

Previously, the council had agreed with the Electricity Board to install a minimum number of power and light points in return for the laying of mains cable. The council intend to install gas cookers in the houses, but next to each will be a point for an electric cooker.

Choice Not Wanted

THE "freedom-of-choice" plea made by both electricity and gas boards in respect of new housing estates, has been described as unnecessary by a Stockport councillor. Clr I. W. Owen said he had found that in some houses an electric cooker point and a gas cooker point had been installed side by side to give the householder a choice. That, he said, was a vicious circle, and we were "getting into the maelstrom of two rival authorities." Clr Owen suggested that the electricity and gas boards should get together. Tenants were being given a choice of cooking by gas or electricity, and it was a choice they did not want.

Metering Exhibition at Science Museum Continues

THE special exhibition at the Science Museum on Electrical Standards and Metering, opened last July to coincide with the meeting in London of the International Electro-technical Commission, is to remain open until 31 Jan. When devised originally it was scheduled to close at the end of Oct. The display is open daily from 10 a.m. to 6 p.m., and on Sundays between 2.30 p.m. and 6 p.m. It will be closed on Christmas Day.

Object of the exhibition is to show the origin and derivation of the various electrical units. It is of special interest to those concerned with the problems of metering bulk electricity supplies, but it is also of interest to the less specialised visitor, and demonstrates the care devoted to the accurate calibration of electricity meters.

OFFICIAL PUBLICATIONS

FUEL CONSERVATION AND PRODUCTIVITY. Action Pamphlet No. 5, pub. by British Productivity Council, 21 Tothill St, S.W.1, 9d. (see page 975).

INVESTIGATION OF ATMOSPHERIC POLLUTION. D.S.I.R. Report on Observations in 10 years to 31 Mar., 1954. H.M.S.O. 7s. 6d.

UNLIMITED POWER NEEDED FOR 100% EFFICIENT FARM

AT the annual meeting of the Eye branch of the N.F.U., the chairman, Mr H. F. Simper, said he did not see how a farm could be 100% efficient without an unlimited supply of electricity. Mr Simper said that farmers generally did not welcome the 10% cut in rural electrification projects, and the Union intended to impress on the Government the need for a continuation in rural development. He also referred to another aspect of electricity supplies in relation to the credit squeeze. Agricultural credit was obviously going to be harder to get, and Mr Simper suggested that to help farmers who had money locked up in their own electrical equipment, the Government should allow them a much higher depreciation figure than at present.

Private Convention on Science Teaching

A THREE-DAY convention for headmasters and careers masters of public schools was organised in Liverpool earlier this month by British Insulated Callender's Cables Ltd., Automatic Telephone and Electric Co., Ltd., and British Telecommunications Research Ltd. Its main purpose was to strengthen the ties between the companies and the science sections of universities and public schools. The programme included visits to the companies' works and training establishments, where particular attention was drawn to the wide scope of training facilities covering electrical, mechanical and civil engineering interests. One afternoon was devoted to a conference on science teaching in schools. Chairman was Dr L. G. Brazier, director of research and education with B.I.C.C., and the main feature was an address by Sir George Thomson on the "Shortage of Scientists."

Rural Electrification Policies Criticised

COMPLAINTS about progress, or the lack of it, in rural electrification schemes were made at recent meetings of the S. Wales and N. Western Electricity Consultative Councils. At the former's meeting in Cardiff, a three-man deputation from Cardiganshire county council criticised the slow rate of development in the country, the fact that some localities had been by-passed and others omitted from the Board's programme, and the apparent lack of co-operation between the S. Wales Board and the Merseyside and N. Wales Board, who were responsible for the northern part of the country. Attention was drawn to the county's population figures which had steadily declined since 1871, and the main reason in recent years, it was stated, was lack of electricity. It was alleged that areas on the borders of the two Boards were being overlooked. The consultative council chairman said their case would be carefully and sympathetically considered, but warned that the full repercussions of the Butler squeeze on the financial fabric of the country were not yet known. The council later agreed to discuss the case fully at their next meeting.

The Butler squeeze was the subject of complaints at the N.W. Consultative Council's meeting. A resolution was passed appealing to the Minister of Fuel and Power to allow the Board to continue rural schemes already promised and approved. People in Cumberland and Westmorland were concerned at the abandonment of schemes on which preliminary work had been done and money spent, it was stated. There was bitterness too at the postponement of the Borrowdale project.

QUEEN OF LIGHT

The 1955 Queen of Light chosen last week in London after a nation-wide competition organised by the British Thomson-Houston Co., Ltd. As reported in these columns last week the attractive Mazda Queen is 22-years-old Mrs Jennifer Chimes from Leamington Spa, who won the Blackpool heat in the competition. The new Queen of Light also holds the title of Miss Great Britain, and our picture fully explains the reason

New TI Acquisition

AGREEMENT has been reached, subject to the completion of formalities, for the acquisition by Tube Investments Ltd., of the whole of the issued share capital of the Power Centre Co., Ltd. The Power Centre Co., with works at Wednesbury and Walsall, manufacture industrial electrical distribution gear, consisting of overhead busbar systems, ironclad switchgear and switchboards, cable trunking and accessories. Separate identity of the Power Centre Co. will be preserved.

NEW E.A.W. BRANCHES

TWO more branches of the E.A.W. have been established. At the end of last month inaugural meetings were held at Northfield, Birmingham, and at Barrow-in-Furness. Officials at Northfield include Mrs Bennett, chairman, and Mrs W. J. H. Robbin, honorary secretary; and at Barrow, Mrs M. Beckett, chairman, and Mrs E. C. Abbott, honorary secretary.

Fuel Efficiency

LATEST in a series of pamphlets published by the British Productivity Council on technical and general subjects related to higher productivity deals with Fuel Conservation and Productivity. It is No. 5 in the series, and follows a number of speeches made by the Minister of Fuel and Power and his Parliamentary Secretary in recent weeks, advocating increased fuel efficiency in industry. The pamphlet explains why economies in fuel utilisation are important both to the individual fuel consumer and as a contribution towards solving current national fuel problems. It goes on to illustrate some common causes of wastage and to suggest some means of saving fuel. Appendices list technical advisory services available, particularly N.I.F.F.S.

The First Half-Century

Here is a specimen of some revised versions of nursery rhymes in the Christmas number of the *Tyneside Electrical Pioneer*, which is a monthly pamphlet circulated by the Newcastle-on-Tyne Electric Supply Company:

Jack and Jylle went uppe ye hylle,
To fetch a payle of water;
Jack fell downe and brake hys croune,
And Jylle came fallynge after.

If Jack hadde hadde electric pumpes,
Ye same as he hadde orter;
They hadde not brake their sylle chumpes,
In drawynge of their water!

—*From our issue of* 21 *Dec.*, 1905.

Prizewinning displays in Hawkins' carnival display contest include H. T. Burgess' window (top left), Moore and Bush's window (top right) and the Super Radio Co.'s display (right)

Winners of Carnival Window Display Contest

RESULTS of the Carnival Window dressing competition organised by L. G. Hawkins and Co., Ltd., were announced last week. A total of 23 prizes was offered for windows featuring the company's range of household products, and the competition formed part of an intensive sales drive which covered the fortnight ending 5 Nov. The competition was open to any dealer who purchased one or more of three special packs each containing a range of products. Dealers entered into the carnival spirit and returned some clever entries. The first prize of £100 was eventually awarded to H. T. Burgess and Son, of Windmill St, Gravesend. Runner-up was the Super Radio Co. (Bradford), Ltd., of Bank St, Bradford, who received £50, and Moore and Bush (Electrical) Ltd., of the Parade, Trowbridge, won the third prize of £25.

In addition to these main awards, the company also gave ten prizes each of £10 and ten Tecals to other commended displays.

Electronic Housewife will only want the Menu

AUTOMATIC cooking was foreseen by Miss Norah Balls, chairman of the national executive committee of E.A.W. when she spoke at the annual luncheon of the Assoc's Thames Valley branch at Tolworth. She visualised a machine which would prepare, cook and serve a meal after the housewife had dropped a menu into it. (Will the machine lay the table as well?)

U.V. LAMPS ON ICE

NEW approaches have had to be found to the age-old themes of Christmas pantomimes now that the majority of producers favour frozen floors. In the changes which have taken place, dramatic lighting effects have played an important role, and not least among those effects is the presentation of complete scenes in Ultra-Violet light. Prominent among arrangements for pantos this year are Thorn Electrical Industries Ltd. We note that their Atlas U.V. tubes will be used in *Sleeping Beauty* at Shrewsbury, *Aladdin* in Edinburgh, *Humpty Dumpty* at Southsea and *Dick Whittington* at Brighton, not to mention Harringay Circus. The U.V. tube has a number of advantages. It strikes immediately on switching and needs no run-up period before reaching maximum efficiency. Because of the larger radiating area the U.V. output from fluorescent tubes is more easily utilised than that from the conventional U.V. lamp. The Atlas tube can also be used with electronic or manually operated fluorescent dimming, and some of the shows already mentioned are using that equipment for main effects lighting.

QUESTIONS IN PARLIAMENT

Purchase Tax

WINDING-UP the debate on the third reading of the Finance Bill last week, Mr R. A. Butler said he thought it would be wrong for traders not to realise that Purchase Tax was an imposition which had to remain as long as the country's inflationary difficulties existed, that any uncertainty about the tax was bad for trade, and that it was much better to take a straight statement from him that the tax had to stay, at least until we had got through present difficulties. Mr Butler said the revenue derived from purchase tax would always be vital to the U.K. economy, and reminded the House that it now brought in nearly £400m. The Chancellor had nothing further to say about the sales tax. An answer had already been given, he said, and repeated that the Government had no sales tax in their pockets and no sales tax plan arranged.

Monopolies Questionnaires

IN view of our report on the Monopolies Commission's questionnaire on street lighting tenders (see our 17 Nov. issue) we note that Sir F. Markham asked last week if the President of the Board of Trade would take steps to control such questionnaires to trade associations because of the many objections made by them to tendentious and derogatory phrases in those questionnaires. Mr D. C. Walker-Smith replied that no action of this kind was being taken, and no objections of the sort mentioned had been made either to the B.o.T. or to the Commission.

Technical Education

SOME time was taken up on Tuesday last week, by a series of questions on technological education, arising, in the main, from Sir Winston Churchill's speech at Woodford a fortnight ago. Initially, Mr E. Fletcher asked what action the Government proposed to remedy the assertion that the U.K. was far behind Russia; Mr A. Henderson suggested a committee of inquiry be set up to investigate all aspects of scientific, technological and technical training; and Mr Emrys Hughes proposed the appointment of a Minister for Technical Education. The Prime Minister reasserted the Government's determination to make a big advance in this sphere, and were fully aware of the problem. He said the Ministry of Education would be making a further statement soon about technical colleges. He did not think, however, that a committee of inquiry would help, nor the appointment of another Minister.

Later the Prime Minister gave facts and figures to illustrate how the matter was receiving immediate attention. Last year, he said, about £4¼m was spent on improvements in various spheres. This year, £7m was being spent, and next year the figure would be £9m. Sir Anthony went on to give details of contracts placed for technical colleges in this country. In 1946-47 there were none, in 1948-49 the amount was £220,000, rising to £874,000 in 1950-51. In 1952-53 the figure rose still more to £3,307,000, and last year it was just under £7m.

Overseas Trade Fairs

AN improvement in the quality and standards of exhibits and pavilions at overseas trade fairs was suggested by Mr A. M. Palmer. He asked what steps the Board of Trade were taking to bring this about. Mr A. R. W. Low told him that the B.o.T. and overseas officers of the U.K. Government gave all the help they could to British exhibitors. He said he had no doubt that British firms gave careful attention to the points Mr Palmer raised because their object in displaying goods was to sell.

H.P. in Press Ads.

FURTHER persistent questions were levelled at the President of the Board of Trade by Miss E. Burton last week concerning misleading details of hire purchase prices in Press advertisements. Miss Burton maintains that the sums of money quoted in the advertisements often confuse the readers, and asks that traders be compelled to state precisely the cash price, number of instalments, amount of each instalment and the H.P. price. Mr P. Thorneycroft agreed that there was some force in the criticism of those advertisements, but he had consulted and discussed the matter with trade associations, and was considering their views which were conflicting. He reminded Miss Burton that legislation would be required to give effect to proposals she was making. (It is understood that the majority of Miss Burton's complaints concern the furniture industry.)

Suppressing Interference

REGULATIONS under the Wireless Telegraphy Act were explained briefly by Mr D. Gammans in a written answer. Cmdr J. F. Maitland had complained of the failure of motorists and other electrical appliance users to fit suppressors, and asked what further steps were proposed to eliminate interference to television sets. Mr Gammans explained that all cars made since July 1953 were fitted with suppressors, and a large number of older cars had been fitted voluntarily. The car problem was therefore a diminishing one, he said. In addition, refrigerators made after 1 Sept. were suppressed. Mr Gammans went on to say there were other regulations dealing with household

NEWS IN BRIEF

To provide high grade interference-free reception of B.B.C. programmes in the Welsh and West regions, the first of six 10 kW F.M. transmitters will shortly undergo operational trials at Wenvoe. Equipment is being supplied by Standard Telephones and Cables Ltd.

The Board of Trade and Council of Industrial Design are to organise a display of British consumer goods on the Great Britain stand in the Milan Fair's Palace of Nations. The Fair will be held from 12 to 27 Apr. next year.

Two hermetically sealed 4 in. diameter dial, circular scale instruments, were supplied to the Trans-Antarctic Expedition by Crompton Parkinson Ltd.

We are reminded by B.E.A.M.A. that the closing date for entries in their essay competition on "The Future and the Trolleybus" is 31 Dec., 1955. Entries should be addressed to the Secretary, Electric Traction Section, B.E.A.M.A., 36 Kingsway, W.C.2.

Five-day residential course on Wage Negotiations and Industrial Relations opens at the Prince of Wales Hotel, De Vere Gdns, Kensington, W.8, on 8 Jan. It is being organised by the Inst. of Personnel Management.

Following an intimation that charges for gas street lighting were likely to rise to £20,000 p.a., Wallsend Council have asked for estimates on installing electric street lights on main roads and bus routes.

The Television Society's annual exhibition has been put forward from 5 Jan. to 6 Mar. next year, it has been announced. Better accommodation will become available then.

Telcon held their annual dinner at Claridge's recently. A gathering of 200 was presided over by Mr J. N. Dean, chairman. Principal guest was Sir Hamish D. MacLaren, director of electrical engineering, Admiralty.

Brighton Council has decided to give to their tenants the wash-boilers, portable fires and other appliances supplied on some estates. The practice of supplying these appliances has been discontinued.

Study in Philosophy for Technologists

LECTURES in philosophy for electrical engineering students are to be introduced at Loughborough College of Technology next term, we hear. The two chaplains have prepared a series of six or eight lectures a term, to be given in weekly periods of one hour, but "purely philosophical and not based on religion." It is aimed at examining the main schools of philosophy and their principles, and applying those principles to present day living. The student will be led to regard himself not just as an engineer but as a person serving the community.

and industrial appliances incorporating an electric motor. Not all caused trouble, but where they did, the owner was asked to fit a suppressor. In the rare case of refusal the owner could be required to do so. There were other sources of interference, but when traced the "offender" usually agreed to have his apparatus put right. Mr Gammans added that consideration was being given to the need for further regulations to deal with non-co-operative owners in those other types of interference.

Rural Electrification

ONCE again a question on proposed cuts in capital expenditure did not receive a definite answer. Mr C. J. Alport asked for a statement on the effects of curtailment in expenditure on rural electrification. Mr G. Lloyd replied that until the comprehensive review of proposals of the Electricity Boards for next year had been completed, it would be premature to make any statement.

Underground Gasification

NO proposals had been considered yet for underground gasification experiments on new sites, Mr G. Lloyd stated in a written answer. Mr T. E. Watkins had asked if proposals had been received concerning experiments in the S.W. Div. of the National Coal Board.

Vehicle Headlamps

FURTHER questions on the subject of dazzle from vehicle headlamps were put by Mr K. Thompson and Mr D. Jones, but the Minister of Transport said he was reserving a decision on a standard specification until he had received the recommendations of the Economic Commission for Europe. Meanwhile, he said, he was seeking powers in the Road Traffic Bill to carry out spot checks on the roads of lighting and other equipment of motor vehicles. A vehicle maintenance campaign, which would include headlamps, was being organised to take place next autumn, he added.

G.P.O. Underground Lines

LAST week, Mr G. Wilson asked what progress had been made in the past two years in putting telephone and telegraph wires underground. Mr D. Gammans said it was policy to put lines below ground wherever it was economic. On the longer routes, the mileage of overhead wires was about one-sixth less than two years ago. Mr Gammans assured his questioner that in all suitable cases, the electricity authorities were consulted in order to effect economies in installation.

Rhodesia's Kariba Project

THE fact that several hundred citizens were losing their land because of the proposed Kariba Hydro Electric scheme, was the subject of a question by Mr S. T. Swingler. The Colonial Secretary said he was awaiting the Governor's comments on the matter, and felt sure that the Governor would have scrupulous regard for the interests of those affected.

ELECTRIC SUPPLY NEWS

Isle of Wight

The second new 12,500 kW turbo-alternator at the Cowes power station of the C.E.A. was put into operation a few days ago. With four older sets also in operation the station is now able to produce about twice as much power as the island's peak period now demands—16,000 kW. The station will thus be exporting to the grid for much of the day.

Londonderry

A new power station, to cost around £3m, is to be constructed at Londonderry by the Electricity Board for Northern Ireland. Initially, the station will have a capacity of 60 MW, we understand. The Electricity Committee of Londonderry Corporation last week decided to recommend to the Council that a site at St. Columb's Park, Waterside, be made available for the purpose. In its communication to the Corporation, the Ministry of Commerce stated that the demand on the present station would likely exceed its safe working capacity within the next few years. While the provision of an adequate supply might be regarded as the responsibility of the Council, they might encounter difficulties, and it was therefore proposed that the Electricity Board should carry out the project. The new proposals in no way affect the ownership or operation of the Council's existing power station or distribution system, the Ministry emphasised.

North Eastern

A large area in North East England suffered a comparatively lengthy power cut on Wednesday of last week as the result of a fault at Stella South power station. Apparently an electrical fault on switchgear at the station caused a fault on the 132 kV busbars, with the result that the local Tyneside distribution system was disconnected from the grid. This caused the overloading of Dunston, Carville and South Shields power stations to such an extent that it was necessary to disconnect those stations also from the local distribution system. Altogether, about 350,000 consumers were affected, including pits in Northumberland and Durham, and electric train services between the coast and Newcastle. The failure occurred about 8.40 a.m., and restoration of supplies began shortly after midday. By the same evening all areas, except for a few rural ones, had been reconnected.

North Wales

Appointed as architect for the proposed Blaenau Ffestiniog power station of the C.E.A. is Mr Leslie Gale, who was responsible for the design of the Authority's Castle Donington power station. At a recent meeting of the Snowdonia Park Joint Advisory Committee, Sir Patrick Abercrombie said he had acquiesced in the appointment. There were a number of safeguards to ensure that the design was suitable for its position. A landscape consultant had also been appointed in connection with the scheme.

Skelton Grange

The probability of further expansion of Skelton Grange power station of the C.E.A. was mentioned at last week's meeting of the Yorkshire Electricity Consultative Council. Mr H. H. Hobbs, of the Yorkshire Division of the C.E.A., said it was planned to extend Skelton Grange to about twice its present size. A new building would go up at the end of the present station and more cooling towers would also be erected. He could not give an estimate of the cost, because a new type of plant was to be installed which might require new authorisation, he added. Skelton Grange "A" has five 60 MW sets installed, with a further similar machine to be added. At Skelton Grange "B" one 60 MW turbo-alternator has been installed, and the Authority has authorisation to add a further five such machines.

Uskmouth

The C.E.A. are now considering proposals put forward by the Usk River Board concerning cooling water from the Authority's proposed Uskmouth "B" power station. At a recent meeting of representatives of the two bodies, the River Board asked the C.E.A. to consider the installation of cooling towers and the use of an alternative point of discharge for the cooling water in order to reduce re-circulation problems. It was also suggested that the cooling water from the station might be spread across the river to avoid concentration of heat on the eastern bank.

LIGHTING SCHEMES

Braintree. A £14,780 scheme for street lighting is proposed.

Colchester. The Highways Committee is ready to carry out the second stage of the new street lighting scheme, at a cost of £6,000.

Manchester. It is proposed to install lighting along Barton Dock Road, Stretford, at a cost of £5,155.

Richmond (Surrey). Ministerial approval has been received to the borrowing of £78,527 for the conversion of lighting in side streets from gas to electricity.

Southport. T.C. has received loan sanction for £35,310 for a street lighting scheme.

Yeovil. The T.C. has decided to complete the conversion of street lighting to electricity in one stage instead of by instalments. Estimated cost is £29,934.

COMPANY ACTIVITIES

BEFORE the mid-week setback started on the Stock Exchange there was some knowledgeable buying of the shares of some of the big electrical manufacturing companies. It was based on reports that tentative talks are taking place at a very high level with a view to a closer integration of the industry in face of rising costs and serious overseas competition. And an additional problem is that every group is now faced with the challenge of the new developments in the electronics and nuclear fields and also the huge demand at home by the railways and the electrical power industry.

One of the greatest problems in connection with these new developments is the securing of skilled technicians to carry out research and design. It was the looming up of this situation, I understand, which motivated the resignation of Lord Chandos from the Government 18 months ago in order to return to the Associated Electrical Industries group. Since then A.E.I. has absorbed Siemens Bros., Australian Electrical Industries and Birmec Ltd. It would cause no surprise if Lord Chandos launched out in a still bigger way, in an effort to pool resources of one kind and another. A.E.I. is a £90 million undertaking; General Electric £81 millions; English Electric £78 millions; B.I.C.C. £65 millions; and A. Reyrolle £17 millions.

The recent results and dividend of Joseph Lucas (Industries) disappointed the market because the board were regarded as being too conservative in their outlook. But I am prepared to back the board. The immediate outlook is clouded by the uncertainties which face the motor trade. It is true that all the motor groups are planning more and more production but there is an intervening period due to Mr Butler's hire purchase restrictions and the increased purchase tax which are likely to impose some check on home demand at least. Export markets are becoming more difficult because of increased overseas competition and continued restrictions in such markets as Australia and New Zealand.

Lucas, have expansion plans in hand in order to meet the increased demand from the motor industry when the present difficulties are passed. But very wisely the board are also planning for increased diversification of products. For instance, more and more aircraft equipment is being included, while other products for the home and the factory are being developed. The financial position is strong with liquid resources of nearly £5·5 millions and free reserves of nearly £12 millions as against an Ordinary capital of £12·6 millions. The 7½% dividend was covered by the latest profits nearly six times over.—*From our City Correspondent.*

Frederick Braby and Co. Ltd.

Trading profit for the year ended 30 Sept. last is £498,684, compared with £308,385 for the previous year. A final dividend of 7½% makes the total distribution 10% (8¾%). After charging depreciation, taxation, etc., the net profit is £128,207 (*£56,732*).

Enfield Rolling Mills Ltd.

An offer has been made to purchase the capital of a private company. If this is accepted, Enfield Rolling Mills propose to make a rights issue of 130,000 £1 Ordinary shares at a price of 62s. a share, on the basis of one for every 12 held. It is hoped to post provisional allotment letters and application forms for excess shares about the end of this month. The new Ordinary shares will rank for the final dividend in respect of the year ended 31 Dec. next.

Ferranti Ltd.

The increase in the borrowing powers, to which we referred on 1 Dec., was approved at the extra-ordinary meeting last Thursday.

R. A. Lister and Co. Ltd.

Profit for the year ended 30 Sept. last is a record. Subject to audit, the figure is £998,250, compared with £859,019 for the previous year, both before charging taxation. There is a final dividend of 7½% on capital increased since the interim by a 40% scrip issue, again making the total distribution 10%.

Mexican Light and Power Co. Ltd.

Net operating revenue for the nine months ended 30 Sept. last amounts to $5,233,095, compared with $3,217,904 for the corresponding period of the previous year. From those sums, interest and commission on debt takes $2,275,074 (*$1,594,748*). Mr W. H. Draper, the chairman, reports that the series of hurricanes in Mexico did no permanent damage to the company's installations. But one hurricane struck the Necaxa area with a flood of rainfall at a time when the reservoirs were already filled to overflowing. One hydro-electric plant was actually flooded and two others temporarily shut down because of damage to canals and tunnels, and because stones and debris in huge quantities piled up and blocked the water intake mouth. Although these plants had a total capacity of nearly 100 MW, the company ran its remaining plants at capacity and was able to weather the storm and to carry the load without restrictions. The peak and kWh demands in October were records.

S. Smith and Sons (England) Ltd.

The new type of combined timing and switching devices including those for cookers, radio sets, washing machines, etc., have had a most promising introduction, Mr R. Gordon-Smith, the chairman, stated at the annual general meeting last week. The industrial instrument branch of the business has had a record year and continues to make very promising progress. The Kelvin and Hughes section has met severe competition, necessitating reduced prices in certain cases. While the turnover and productivity efficiency of the group have been increased over the last few years, Mr Gordon-Smith stresses that any further increases in costs will in part at least have to be recovered. As in the national interest, export business must not be jeopardised, this means that increased costs will need to be absorbed largely by the home market. Concerning future prospects, in spite of the credit squeeze and the increase in purchase tax, the sales of the group as a whole have increased still further in the last four months. It may well be that the group's present expansion plans in this country and those in Australia will call for the raising of additional capital in the future, particularly if the new products under development prove to be the success anticipated.

Year to 31 July	£ Agte Profit	£ Net Profit*	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1951	2,016,283	603,190	64	12½	11/-	7/10
1952	1,790,919	428,406	44	12½	9/9	7/9
1953	2,793,245	623,317	60	15	12/9	7/11
1954	3,483,246	1,136,075	69	17½†	17/7	7/8
1955	3,412,176	1,328,735	77	17½	20/4	14/6

*Available for parent company.
†Plus 60% capital bonus.

Sperryn & Co. Ltd.

The improvement shown last year is still continuing and orders being received are ample to maintain the present output, Mr G. Neville Sperryn states. Export trade has been maintained despite keen foreign competition.

Dividend Declared

Telephone Rentals. Interim 5% (4%).

Sayings OF THE WEEK

"Women's emancipation will not be complete until all the homes can be run by the pressing of a switch." . . . MR A. E. SELBY, at the Midlands and East Midlands branch, E.A.W. dinner.

"Although the railways are facing a great staff shortage, no attempt has been made to save manpower by modern methods. There must be some lesson to be learned from the smooth running of the Central Electricity Authority." . . . VISCOUNT BRIDGEMAN, in the House of Lords.

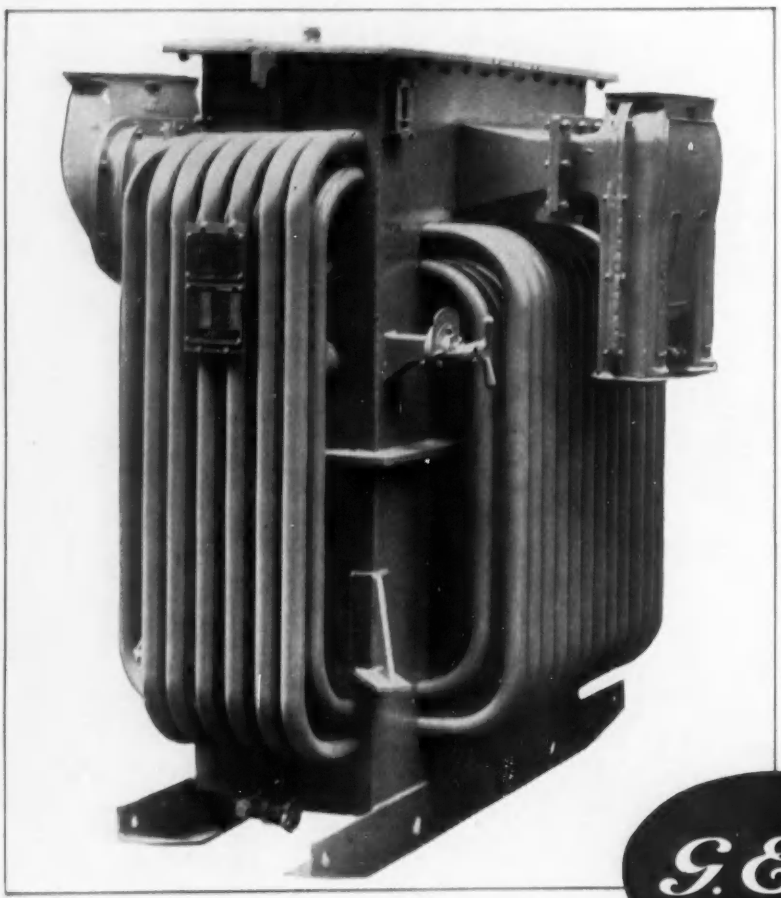
"I do not believe that the 'learned societies' have any educational function at all, only six people in 100 at technical lectures understand what the speaker is talking about." . . . MR C. G. DUCE, hon. sec. of the Joint Council of the Kindred Engineering Societies.

BRITISH THROUGHOUT

Built to Central Electricity Authority Specification T.1

or to customers' own requirements.

5 to 1000 kVA



G.E.C.

transformers

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

23 Dec.—Stranraer T.C. Mercury vapour lanterns with control gear wiring and concrete columns along trunk roads.—See 8 Dec. issue.

24 Dec.—Rayleigh U.D.C. Columns with sodium lights along A.1015.—See 15 Dec. issue.

28 Dec.—Bridgwater T.C. Concrete columns with sodium lamps, etc., for Relief Rd.—See 8 Dec. issue.

28 Dec.—Marshland R.D.C. Installation in 26 houses at Walpole St. Peter.—See 24 Nov. issue.

28 Dec.—Wandsworth B.C. Polythene insulated armoured cable.—Advertised in 15 Dec. issue.

29 Dec.—Co. Down. Installation at Dundonald intermediate school.—See 8 Dec. issue.

29 Dec.—Kirkcaldy T.C. Installation in five shops and five maisonnettes in Links St.—See 8 Dec. issue.

29 Dec.—Lancashire. Electrical installation at Kirkby Agriculture and Apprentices Hostel. Apply by above date to County Architect, P.O. Box 26, County Hall, Preston, quoting ref. A/LP.

30 Dec.—Hendon T.C. Sodium lamps, lanterns, transformers, condensers, etc., on concrete columns. Apply by 17 Dec. —Advertised in 8 Dec. issue.

30 Dec.—Kingston-on-Hull T.C. Installation at Greatfield primary school.—See 15 Dec. issue.

30 Dec.—Reading T.C. Wiring of 128 houses on Whitley estate. Borough Architect, Town Hall.

31 Dec.—Bristol. Electrical equipment for College of Technology.—See 1 Dec. issue.

31 Dec.—Cheshire. Applications for inclusion on official list for supply of lamps.—See 8 Dec. issue.

31 Dec.—Hastings T.C. Electrical installation in 15 flats and a shop at Harley Shute Extension. Apply to Borough Engineer, 37 Wellington Sq, by above date. Deposit £2. 2s.

31 Dec.—Co. Louth. Installation at Bush vocational school.—See 15 Dec. issue.

31 Dec.—Middleton T.C. Installation in 68 houses and 36 flats.—See 1 Dec. issue.

31 Dec.—Nailsworth U.D.C. Supply and erection of 19 concrete columns and electrical equipment for twenty 250 W mercury discharge lamps along A.46 Bath-Cheltenham trunk road. Surveyor to Council, Council Offices. Deposit £1.

31 Dec.—West Riding. Contractors invited to apply for names to be included on lists of selected contractors.—Advertised in 17 Nov. issue.

31 Dec.—Worsley U.D.C. Fittings for conversion of gas street lighting to electricity—See 15 Dec. issue.

31 Dec.—Wrexham R.D.C. Installations in 110 houses at Cefn, Esclusham Below, Gwersyld, Penycae and Ruabon.—See 1 Dec. issue.

1 Jan.—Litherland U.D.C. Electrical installation in 18 houses in Southport Rd. Apply by above date to Engineer and Surveyor, Town Hall.

2 Jan.—Finsbury B.C. Lamps in year from 1 Apr.—See 15 Dec. issue.

3 Jan.—Watford T.C. Installation of street lighting at Cecil Lodge, Abbots Langley. Council's Architects, Dawe, Carter and Partners, 33 Clarendon Rd. Deposit £1. 1s.

4 Jan.—Stockton-on-Tees T.C. Group A concrete columns, and sodium vapour discharge lamps, lanterns and ancillary equipment, for relighting A.19.—Advertised in 15 Dec. issue.

6 Jan.—Dublin. Installation of St. Mac Dara's National School, Carranoe.—See 15 Dec. issue.

7 Jan.—Bootle T.C. Supply of electric lamps, cables and other electrical goods in year from 1 Apr. Borough Surveyor, Town Hall.

7 Jan.—Castleford T.C. Provision and installation of 13 lighting points comprising 140 W sodium discharge lamps on 25 ft concrete columns along Lock Lane. Contract C/4/103. Borough Engineer and Surveyor, Town Hall. Deposit £2. 2s.

7 Jan.—Dagenham T.C. Lamps, cables, conduit and accessories in year from 1 Apr.—See 8 Dec. issue.

7 Jan.—Ruislip (Middlx.) U.D.C. Supply of lamps from 1 Apr.—See 1 Dec. issue.

9 Jan.—Bridlington T.C. Re-equipment of Burton Agnes pumping station with electrically operated centrifugal pumping plant.—See 15 Dec. issue.

9 Jan.—Lanarkshire. Mercury discharge lanterns with chokes and capacitors for lighting A.8.—See 15 Dec. issue.

9 Jan.—Romsey T.C. Lighting points in 22 houses at Lansdowne Close.—See 15 Dec. issue.

9 Jan.—Whitley Bay T.C. Pedestrian controlled electric vehicles for road sweepings.—See 15 Dec. issue.

11 Jan.—Dublin T.C. Sewage pumps and electric motors and storm water pump and electric motor for Kilbarrack pumping station.—See 27 Oct. issue.

13 Jan.—Co. Limerick. Installation at courthouse.—See 15 Dec. issue.

16 Jan.—Keynsham U.D.C. Electrical installation in 120 dwellings on Park West estate. Engineer and Surveyor, Council Offices, Keynsham, Bristol. Deposit £2. 2s.

19 Jan.—Co. Down. Electrical installation at Banbridge intermediate school. A. N. Irens, consulting engineer, 16 Bedford St, Belfast. Deposit £3. 3s.

20 Jan.—Lincolnshire. Rewiring at St. George's Residential estate, Stamford.—See 8 Dec. issue.

21 Jan.—Halesowen T.C. Supply and erection of 81 Class A mercury discharge lamps and 65 Class B fluorescent mercury discharge lamps on concrete columns for street lighting scheme. Borough Engineer and Surveyor, Council Hse. Deposit £2. 2s.

25 Jan.—Fareham U.D.C. Supply of electrical fittings and lamps in year from 1 Apr. Engineer and Surveyor, Westbury Manor, West St.

26 Jan.—Belfast T.C. 33 kV and lower voltage cables and accessories.—Advertised in 8 Dec. issue.

27 Jan.—Belfast T.C. Five 33/6·6 kV 12,500 kVA outdoor stepdown transformers with on-load tap changing equipment.—Advertised in 8 Dec. issue.

28 Jan.—Swansea T.C. Supplies in year from 1 Apr. include street lighting cable, concrete and steel pillars, public lighting equipment and lamps. Borough Engineer and Surveyor, Guildhall.—Advertised in this issue.

No date stated.—Liverpool. Lamps for Fazakerley Hospitals Committee.—See 15 Dec. issue.

No date stated.—N. of Scotland H.E. Board.—132 kV isolators, 33 kV switchgear, neutral earthing resistances and ancillary equipment, for Persley substation.—Advertised in 15 Dec. issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

5 Jan.—South Africa. Tenders invited for supply of 27,720 yd of p.v.c. switchboard cable. Union Tender and Supplies Board, 291 Bosman St, Pretoria. B.o.T. (Ref.: ESB 25356/55).*

6 Jan.—South Africa. Tenders (G5423) invited for supply of 172,000 ft of 56 core p.v.c. signalling cable for secondary cir-

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 106 queries answered this week

Spin dryers on domestic lines but larger than domestic in size, makers of? E.B.—Neil and Spencer Ltd., Station Rd, Leatherhead; G. L. Murphy Ltd., Imperial Works Menston, near Leeds.

"Atomic" espresso type coffee makers, makers of? H.T.G.—A. and M. G. Sassoon, 38 Lowndes Sq, S.W.1.

Trolleys for making washing machines mobile, makers of? S.R.S.—Chardcraft Products Ltd., 124 St. Margarets Rd, Twickenham.

"Itonia" irons, repairers of? S.E.B.—H. Chapman, 71 Goldsworth Rd, Woking, Surrey.

Battery operated clocks, suppliers of? R.H.—McKellen Clocks, Bromsgrove, Worcs.

"Kitman" fluorescent equipment, address for? J.E.—Drubel Distributors Ltd., 19/21 Stafford Rd, Croydon.

"Latralok" switchfuses, makers of? S.E.B.—Were made by the Carlisle Electric Mnfg. Co., Ltd., whose switchgear section was purchased by Dexray Eng. Co., Ltd., Brock St, Lees St, Manchester 1.

"Caledonia" fires, makers of? J.H.—These were made, before 1937, by Lane and Girvan Ltd., Bonnybridge, Glasgow.

cuits, outdoor use. Stores Dept., S. African Railways, Johannesburg. B.o.T. (Ref.: ESB 26703/55).*

6 Jan.—S. Rhodesia. Supply of about 26 circuit-breakers to various specifications for delivery to Umtali, Umniati, Fort Victoria and Shabani. Specif. No. SWC/55. Secretary, Electricity Supply Commission, P.O. Box 377, Salisbury. B.o.T. (Ref.: ESB 26318/55).*

9 Jan.—South Africa. Supply of various street lighting fittings, including 140 W sodium vapour lamps, vacuum jackets, leak transformers and correcting condensers. Contract E.17/55. City Electrical Engineers' Dept., Municipality of Kimberley, City Hall. B.o.T. (Ref.: ESB 27357/55).*

11 Jan.—South Africa. Tenders (C.630) invited for supply of total of 9,000 ft of rubber insulated electric cable to various specifs. Stores Dept., S. African Railways, Johannesburg. B.o.T. (Ref.: ESB 27363/55).*

13 Jan.—South Africa. Stores Dept. of S. African Railways, Johannesburg, invites tenders (C.5483) for supply of total of 51,100 lb of hard drawn copper wire. B.o.T. (Ref.: ESB 27364/55).*

13 Jan.—South Africa. Supply of (a) 56 transformers (50 kVA to 750 kVA) of 3-phase double-wound core type, oil-immersed, natural cooled and for outdoor service; and (b) total of 175,250 ft underground electric cable. Separate tenders, contract Nos. E.2654 and E.2661 resp., invited by City of Durban Electricity Dept., Municipal Buildings, West St. B.o.T. (Refs.: ESB 26876/55 and 2685/55 resp.).*

14 Jan.—Rhodesia and Nyasaland. Supply and erection of 330 kV cable and ancillary cables; shunt compensating reactors; and main and auxiliary switchgear, for Kariba Hydro-Electric scheme. Details of qualifications, etc., to Secretary, Federal H.E. Board, P.O. Box 630, Salisbury, S. Rhodesia, and Merz and McLellan, Carliol Hse, Newcastle-on-Tyne, by above date.—Advertised in 15 Dec. issue.

19 Jan.—South Africa. Union Tender and Supplies Board, 291 Bosman St, P.O. Box 371, Pretoria, require 26 vacuum cleaners and 33 floor polishers to various specifications. B.o.T. (Ref.: ESB 26957/55).*

20 Jan.—South Africa. Supply of six sets of 11 kV 3-phase outdoor type pole mounted oil filled automatic reclosers. Contract E.2641. City of Durban Electricity Dept., Municipal Buildings, West St. B.o.T. (Ref.: ESB 26877/55).*

23 Jan.—Egypt. Cairo Tramway Co. require 100 to 125 trolley buses. Documents at £E.5 from company's offices at 1 Sharia Maspero, Cairo.

23 Jan.—India. Supply and erection of 96 miles of 66,000 V 3-phase double circuit transmission line with A.C.S.R. conductor size 0·1 sq in. copper equivalent between Salawa-Muradnagar-Sumera substation of Ganga Hydel Grid. Forms at Rs. 15 from Superintending Engineer, Hydel Ganga Circle, Roorkee.

26 Jan.—New Zealand. Supply of 30 vacuum cleaners, 12 blower and suction tools and 24 floor polishers for N.Z. Post Office. Tender No. P. and T. 150/8456. Director General (Stores Div.) G.P.O., Wellington. B.o.T. (Ref.: ESB 25979/55).*

27 Jan.—Australia. Supply and erection of 415V 3-phase 50-cycles switchgear with control and metering equipment for Mackay Harbour Board. Contract 15A. Secretary of Board, Mackay, N. Queensland. B.o.T. (Ref.: ESB 27056/55).*

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Monday, 19 December

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	403	+2	282½
,, (3 months)	396½	+2½	268½
R.S.T. (Rhodesian Selection Trust) group price*	360	—	—
LEAD, refined pig, min. 99·97% purity (cash)	113	−1	103½
,, (3 months)	112½	½	102½
TIN, refined, min. 99·75% purity (settlement)	835	−5	692½
,, (3 months)	816	−9	693½
ALUMINIUM, ingots 99·99·5%	171	—	156
ZINC, virgin, min. 98% purity (cash)	98½	−1	82½
,, (3 months)	95½	−1	82
RUBBER No. 1, RSS. spot (per lb.)	36¾d.	−¼d.	26¼d.
,, c.i.f. basis, ports, Jan. (per lb.)	36¼d.	+¼d.	25¼d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	56½	—	52½
Mild Steel Tape (0·04 in.)	43½	—	40½

(*Fixed price c.i.f. U.K., now subject to change at 24 hours' notice, to "consumers willing to instil a degree of stability into the resale price.")

27 Jan.—India. Various transmission line material, including insulators, conductor accessories, line, tools, capacitors, etc., required under I.C.A. Procurement for India. Project SE/4065/F. Director General Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. (Ref.: ESB 26023/55).*

31 Jan.—New Zealand. Supply of cable test equipment, including pulse echo, high voltage, capacity unbalance and insulation resistance test sets. Tender No. P. and T. 150/8492. Director General, Stores Div., G.P.O., Wellington.

3 Feb.—Nicaragua. Bids invited concerning National Power System, involving 30 MW thermo-electric power plant, expansion and renovation of existing distribution systems in Managua, and about 110 miles of 69 kV transmission lines, 57 miles of 13·2 kV lines, 6 receiving substations, one sending substation, and distribution systems for 15 towns. Empresa Nacional de Lux y Fuerza, c/o The Kuljian Corporation, 1200 North Broad St, Philadelphia 21, Pennsylvania, U.S. B.o.T. (Ref.: ESB 14277/55).*

13 Feb.—Iraq. Supply, erection, etc., of three each 15,000 kW turbine generator sets at Dibis power station, and two each 20,000 kW turbine generator sets at Baghdad power station. Documents from Iraqi Embassy in London.

29 Feb.—India. Supply and installation of four turbines and one house turbine-generator. Central Purchasing Officer, Govt. of Bombay, Old Custom Hse Yard, Bombay. B.o.T. (Ref.: ESB 26274/55).*

7 Mar.—Australia. State Electricity Commission of Queensland invite tenders (specif. No. 523) for supply, erection, etc., of convertible engine driven electrical generating plant for Emerald Shire Council: two approx. 150 kW sets are required. Commission is at Scottish Union Hse, Eagle St, Brisbane. B.o.T. (Ref.: ESB 27057/55).*

14 Mar.—Uruguay. Tenders (2,500) invited for 27·8 km overhead line for 150 kV Montevideo collector system. Administracion General de las Usinas Electricas y los Telefonos del Estado. B.o.T. (Ref.: ESB 25778/55).*

22 Mar.—India. Supply and erection of 220 kV transmission lines from Koyna power station to Bombay Terminal Station. Tender notice 71. Central Purchasing Officer, Govt. of Bombay, Old Custom Hse Yard, Fort. B.o.T. (Ref.: ESB 27058/55).*

26 Mar.—India. Govt. of Bombay invites tenders (notice No. 70) for supply and installation of various power transformers for Koyna Hydro Electric scheme. Central Purchasing Officer, Old Custom Hse, Yard, Fort. B.o.T. (Ref.: ESB 27059/55).*

Gazette Announcements

COMPANIES ACTS

C. Saunders and Co. (Electrical Contractors) Ltd. R. F. Bendall of 126 Colmore Row, Birmingham, has been appointed liquidator, with committee of inspection.

Mercury Sound Recordings Ltd. Meetings of creditors and contributories will take place tomorrow (23 Dec.) at Inveresk Hse, (Room 401), 346 Strand, London, W.C.2, at 11.30 a.m. and 12 noon resp.

Corona Lampworks (Southern) Ltd. Meetings of creditors and contributories will take place at Inveresk Hse, (Room 401), 346 Strand, London, W.C.2, tomorrow (23 Dec.) at 10.15 a.m. and 10.45 a.m. resp.

BANKRUPTCY ACTS

Release of Trustee

Grimsby. Brian T. Smith, electrical engineer and contractor trading at The Studio, Ramsgate, Louth. Trustee was L. F. McCulloch, C.A., 26 South St. Mary's Gate, Grimsby.

Intended Dividends

Huddersfield. Donovan J. Hartshorne, electrical and mechanical engineer, trading as Boyce, Weir and Co., at 778 New Hay Rd, Huddersfield, and Brook Royd Mills, Stainland, nr Halifax. Last day for receiving proofs, 28 Dec. Trustee is N. Smith, 12 Market St, Hebden Bridge, Yorks.

Contracts Placed

Darlington T.C. Street lighting contracts include: supply of cast iron standards, General Electric Co., Ltd., £6,430; and of cables and jointing-up, N.E. Electricity Board, £2,704.

Newcastle-on-Tyne. Supply and installation of lift at Northern Counties training college of cookery. Austin Lifts Ltd., £2,460.

West Hartlepool T.C. Installation of electricity at Brierton county secondary school. B. French Ltd.

BUSINESS PROSPECTS

Belford (Northumb) R.D.C. Construction of 20 flats on five blocks on Meadows estate. K. Glover, Architect, Beadnell, Chathill.

Birmingham T.C. It is proposed, subject to Home Office approval, to erect 204 police dwellings during 1955-56.

Bromborough. Site being sought on Bromborough Port industrial estate by Michelin Tyre Co., Ltd., 54 Buck St, Liverpool, for erection of factory.

Bromley T.C. Included in 1956-57 housing programme are erection of 28 dwellings on Blackbrook estate, and 16 on Clarence Rd/Bickley Crescent site.

Chatham. Acquisition of site being considered by Min. of Works for erection of Post Office sorting office and garage.

Cheshire. Erection of Tarporley secondary modern school. E. Mainwaring Parkes, County Architect, The Castle, Chester.

Chesterfield. Plans approved by R.D.C. for laboratories, offices and works in Mill Lane, Wingerworth, proposed by British Coke Research Assoc.

Chingford T.C. Erection of municipal hall and county library in Station Rd. C. G. Dennis, town clerk, Town Hall, The Ridgeway, E.4.

Colchester T.C. Construction of a shopping hall on Shrub End housing estate. Borough Engineer's Architectural Dept., 64 West Stockwell St.

Cookham (Berks) R.D.C. Negotiations proceeding for acquisition of 8-acre site at Heywood Lodge, Woodlands Park, from Air Ministry, for proposed housing development.

Coventry. Construction of six unit factories proposed at Fletchamstead Highway. City Architect, Bull Yard.

Crawley. Construction of ten shops with 11 maisonnettes on Southgate site, 4 shops with 3 maisonnettes on Three Bridges site, and 10 houses on Langley Green site, for Development Corpn. Chief Architect, Broadfield, Crawley.

Croydon. Plans have been submitted by New Avenue Press Ltd., 3 Sherwood St, London, W.1, for printing works and offices on Brighton Rd.

Croydon T.C. Erection of 11-storey block of 86 flats in Duppas Hill Terr. Borough Engineer, Town Hall.

Cumberland. Construction of clinic and administrative offices at Flatt Works, Whitehaven. J. H. Haughan, County Architect, Portland Sq, Carlisle.

Doncaster T.C. New secondary modern school, estimated to cost £156,978, is to be built at Intake.

Ellesmere. Approval received by R. J. Fullwood and Bland Ltd., for erection of factory in Grange Rd.

Epsom and Ewell T.C. Tenders may soon be invited for construction of 150 houses on part 1 of sewage farm site.

Essex. Erection of Wanstead Nightingale secondary school; Aveley county technical school; Colchester county high school for girls; and Harlow College of Further Education. H. Conolly, County Architect, County Hall, Chelmsford.

Eston U.D.C. Twenty houses to be built on Teesville East estate. Plans by N. C. Harrison, surveyor, 246 Normanby Rd, South Bank-on-Tees.

Evesham T.C. It is proposed to erect 46 houses in second phase of Fairfield No. 7 scheme. Tenders may be invited shortly.

Hebburn-on-Tyne. New drawing offices to be built by Baker Perkins Ltd., of Bedewell Works, Hebburn.

Hindley U.D.C. Construction of 71 houses on Wooddagger estate. Engineer and Surveyor, Town Hall.

Leicester T.C. It is proposed to erect new junior and infants' schools in Wigston Fields.

Also appointment of Handcock and Dykes, 12-14 Old Pye St, Westminster, consulting engineers for a.c. supply at Carlton Hayes Hospital, Narborough, recommended to Sheffield Hospital Board.

Leeds. Black and Luper Ltd. are to build new factory and offices on Kirkstall Rd industrial estate.

Lincoln. Installation of a.c. supply proposed at Bracebridge Heath Hospital. Sheffield Hospital Board recommended to appoint E. G. Phillips, Son and Norfolk, Arskus Hse, Annesley Grove, Nottingham, consulting engineers.

Loughborough T.C. About 120 houses to be built in each of next five years.

Manchester. Factory and offices in Floats Rd, Roundthorn industrial area, Wythenshawe, proposed by Stanweld Engineering Co., Ltd. Plans by J. W. Beaumont and Sons, 51 Mosley St.

March (Cambs) U.D.C. It is proposed to build 50 bungalows on Badgeney estate.

Margate T.C. Scheme being considered for development of Millmead Rd and Dane Valley/Millmead Rd sites, by erection of some 145 dwellings.

Merrow (Sur). It is proposed to erect primary school at cost of about £68,220.

Peterborough. New police station to be built at Fletton during 1956-57. Estimated cost, £52,000.

Potters Bar (Middx) U.D.C. Oakmere estate is site for erection of total of 98 houses.

Ramsgate T.C. Tenders may soon be invited for electrical installation at the library.

Salford T.C. Erection of Hope Hall secondary modern school in Eccles Old Rd. Architects: J. C. Prestwich and Sons, Bradshawgate Chambers, Leigh.

Scunthorpe T.C. Schemes proposed for 16 bungalows on New Brumby estate, 82 dwellings on Riddings estate, and a further 50 dwellings on unspecified site.

Sedgefield. Additions costing some £104,000 are proposed at Winterton Hospital by Newcastle Hospital Board, whose architect is P. H. Knighton.

South Shields T.C. Erection of 88 houses on Whiteleas estate. Borough engineer, Town Hall.

Stoke-on-Trent T.C. Application to be made to borrow £1,125 for improvements to electric lighting at Moorland Rd county secondary and primary schools.

In addition, application also to be made to borrow £167,355 for Chell Heath county modern school, and £71,767 for replacement of old buildings at College of Further Education, Cauldon.

Strabane (N.I.). Erection of new voluntary intermediate school at Melmount. Architects are F. M. Corr and W. H. D. McCormick, 7 Ferryquay St, Derry.

Sunderland. Plans submitted by Aiton and Co., Ltd., for rebuilding drawing offices and processing shops, recently destroyed by fire.

Swansea T.C. Construction of new primary school at Bonymaen. Borough Architect, The Guildhall.

Also the erection of primary school at Bonymaen. Borough Architect, The Guildhall.

Swindon T.C. Quantity surveyors for crescent block of flats and maisonnettes in Walcot neighbourhood, will probably be Bare, Leanning and Bare, 3 Argyle St, Bath.

Tipton T.C. Erection of 144 dwellings on Princes End site. Housing Architect, Municipal Buildings.

Wednesbury. Plans in hand for factory on Portway estate for Emms and Evans, 58 Hydes Rd. Also, Newmans Tubes Ltd., are planning extensions to their factory in Holyhead Rd.

Welwyn Garden City. It is proposed to erect grammar school at estimated cost of £210,807.

Westminster. Offices in Vauxhall Bridge Rd to be built by London Investment and Mortgage Co., Ltd., 18 Upper Brook St, W.1.

West Riding. It is proposed to erect infants' school on site of existing Rawmarch Monkwood school.

Weston-super-Mare T.C. Erection of 100 dwellings on Oldmixon estate. R. G. Lickfolk, town clerk, Town Hall.

Wortley (Yorks) R.D.C. Erection of 24 flats at High Green. Husband and Co., 388 Glossop Rd, Sheffield 10.

TRADE NOTES

Beama Contract Price Adjustment Formulæ.—*For Electrical Machinery and Equipment.* For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 17 Dec., 1955, shall be deemed to be 162s.; (*b*) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry published in the Board of Trade Journal on 17 Dec., 1955, is 192·8.*

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 17 Dec., 1955, shall be deemed to be 162s.; (*b*) "Cost of Material"—the index figures published in the Board of Trade Journal on 17 Dec., 1955, are: Materials used in Mechanical Engineering Industries—174·6.* "Blast Furnaces and Iron and Steel Melting and Rolling (40 and 41)"—156·9.* The prices of brass condenser tubes, ¼ in. o/d 18 s.w.g. published in *The Metal Bulletin* on 16 Dec., 1955, is 4s. 8¼d. per lb.

For Outstanding Contracts covered by the B.O.T. Intermediate Products Index. For purposes of calculating variations in (*a*) "Rates of Pay"—the rate of pay for adult male labour at 17 Dec., 1955, shall be deemed to be 162s. (*b*) "Cost of Material"—the index figure for Intermediate Products published in the B.o.T. Journal on 17 Dec., 1955, is 379·7.*

* Provisional figure.

New Branch. J. H. Fenner and Co., Ltd., have opened a new branch for mechanical power transmission equipment at 50 Southgate St, Leicester. The branch manager is Mr W. K. Porter.

Change of Address. Land, Speight and Co., Ltd., and its associate concern, Elesco Electronics Ltd., have moved to 2 Fitzroy Place, Sauchiehall St, Glasgow, C.3. The telephone number remains Central 1082.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Howorth and Larter Ltd., 17 St. James' St, Bacup, Lancs. Electricians, mechanical engineers and manufacturers, etc. Nom. cap.: £3,000. Dirs.: H. Howorth and H. Larter.

A. M. Frodsham and Co., Ltd., 113 College Rd, Gt. Crosby, Liverpool 23. Motor, aeronautical, electrical, mechanical, agricultural and general engineers, etc. Nom. cap.: £1,000. Dirs.: A. M. Frodsham and Mrs D. C. Frodsham.

Avery and Co. Engineering (Maidstone) Ltd., Penenden St, Maidstone, Kent. Electric, acetylene and oxy-acetylene welders, ironfounders, etc. Nom. cap.: £1,000. Dirs.: E. C. Avery and K. Avery.

F. and O. Advance Electrics (Harrow) Ltd., 854 Kenton Lane, Harrow Weald, Middlesex. To take over business of electrical and general engineer, joiner, builder, plumber, dealer in and repairer of electrical appliances, television, radio, mechanical toys, etc., carried on at Harrow Weald by William George Frost. Nom. cap.: £2,000. Dirs.: W. G. Frost and J. Orange.

Richmond Radio Ltd. Manufacturers of and dealers in electrical, radio and television equipment, etc. Nom. cap.: £10,000. Dirs.: Mrs M. E. Willmott, 99 Belmont Ave, Cockfosters, Herts.; and W. Bocking, 106 Chatsworth Cres, Hounslow, Mdx.

H. J. Edwards Electrics Ltd., Tudor Chambers, Station Rd, Wood Green, N.22. Nom. cap.: £2,000. Dirs.: H. J. Edwards and Miss P. R. Sifleet.

S. J. Clark (Cables) Ltd., 93 St. Clements Rd, Birmingham. To take over business carried on at Birmingham by Sidney J. Clark. Manufacturers of and dealers in cables, cable transmissions and controls and all kinds of accessories for use in motor cars, bicycles, aeroplanes, etc. Nom. cap.: £30,000. Dirs.: S. J. Clark, Dora E. Clark and E. E. B. Clark. Subs.: F. P. Taylor, 74 Hesketh Crescent, Birmingham 23; and F. W. Salter, 66 Elizabeth Rd, New Oscott, Sutton Coldfield (clk).

J. E. Draper Ltd., 23 Lumley Rd, Skegness, Lincs. To take over business of ironmonger and electrical contractor carried on at Skegness, Lincs., by John E. Draper. Nom. cap.: £15,000. Dirs.: J. E. Draper and Mrs M. E. Draper.

Jotcham and Kendall Ltd., The Tamarisks, Wotton-under-Edge, Glos. To take over business of building contractors, decorators and plumbers and heating, lighting and sanitary engineers carried on as "Jotcham and Kendall," at Wotton-under-Edge. Nom. cap.: £5,000. Dirs.: J. M. Jotcham, V. H. Jotcham and J. S. W. Fairbairn.

Ivor Morris Construction Co. (Cardiff) Ltd., 27 Waterloo Gdns, Cardiff. Heating hydraulic, gas, electric, turbine, mechanical and general engineers, precision engineers, tool makers, etc. Nom. cap.: £1,000. Perm. dirs.: I. Morris and Vera Morris.

M. P. Woodhouse Ltd. Manufacturers of and dealers in electrical and mechanical apparatus, in particular wireless and television sets, etc. Nom. cap.: £3,000. Dirs.: To be appointed by subs. Subs.: Mrs M. Q. van Koert and Mrs M. P. Woodhouse, Old Farm Hse, Rottingdean, Sussex.

Silver Voice Ltd., 77 Portland Place, W.1. Radio, electrical, sound recording and television apparatus manufacturers and dealers, etc. Nom. cap.: £100. Dirs.: A. Leigh and Irene Leigh.

Southern Assemblies Ltd., 134 Chesterfield Rd, Ashford, Middx. Mechanical, electrical and general engineers, tool makers, etc. Nom. cap.: £100. Dirs.: F. S. Smith, G. R. Sugiero and S. A. Whiting.

J. W. Davis (Plymouth) Ltd., Rendle St, Plymouth, Devon. Wireless, electrical and television engineers and dealers in electrical apparatus, etc. Nom. cap.: £8,000. Perm. dirs.: J. W. Davis and N. J. Davis.

Woking Electrical Installations Ltd., Hascombe, Brooklyn Rd, Woking, Surrey. Nom. cap.: £100. Dirs.: O. M. Davey and E. C. Davey, and J. Whyte.

J. H. Letchford Ltd., 75 and 77 Market St, Droylesden, Manchester. To take over business of retail radio, television and electrical dealer and repairer and petrol salesman, carried on as "Central Garage" by Jas. H. Letchford at Droylesden. Nom. cap.: £10,000. Dirs.: J. H. Letchford and Mrs A. B. Letchford.

Hartley Banks Ltd., 43 Brunswick Sq, Hove. Electrical engineers and contractors, etc. Nom. cap.: £1,000. Dirs.: W. C. Challen, Nellie A. Richards and J. Cording.

Hyclamet Co., Ltd., Breakaway, Brookhill Rd, Copthorne, Sussex. Electrical, mechanical, research, planning, designing, and general engineers, etc. Nom. cap.: £1,000. Dirs.: R. C. Chard, H. J. Baylis, and S. Seymour.

Monteith Electrical Co., Ltd., 97 Station Rd, Histon, Cambs. To take over business of electrical engineers and contractors carried on at Histon by Robert C. Monteith. Nom. cap.: £4,000. Dirs.: R. C. Monteith and L. A. Stearn.

Electro-Vac (Ashbourne) Ltd., Belle View Works, Belle View Rd, Ashbourne, Derbyshire. Manufacturers of and dealers in television tubes, wireless and television sets, etc. Nom. cap.: £1,000. Dirs.: E. A. Higton, J. Shemilt, G. West and R. A. Minns.

MEETINGS TO NOTE

FRIDAY, 23 DEC.

LEICESTER ELECTRICAL SOC. Christmas Party at the Trocadero.

TUESDAY, 27 DEC.

ROYAL INSTN. First of annual Christmas Lectures: "Big Molecules," by Prof H. W. Melville. 21 Albemarle St, W.1, 3 p.m.

THURSDAY, 29 DEC.

I.E.E. (London). Annual Christmas Lecture for School Children: "Electric Traction." R. Brooks. Savoy Place, W.C.2, 3 p.m. (repeated on 30 Dec.).

PURCHASING OFFICERS' ASSOC. (West). "Atomic Energy and Industry." M. F. Jones. Royal Hotel, Bristol, 7.30 p.m.

SATURDAY, 31 DEC.

COMMERCIAL TRAVELLERS' BENEVOLENT ASSOC. Annual Court of Governors at Berners Hotel, Berners St, W.1, 12 noon.

MONDAY, 2 JAN.

I.E.E. (E. Anglia). "Industrial Application of X-Rays." F. L. Veale. Crown and Anchor Hotel, Ipswich, 6.30 p.m.

TUESDAY, 3 JAN.

I.E.E. (N. Midland). "Electrical Engineering Industry in the Post War Economy—II." G. L. E. Metz. Elect Offices, 1 Whitehall Rd, 6.30 p.m.

I.E.E. (N. Western). "Highland Water Power—Developments of N. of Scotland Hydro-Electric Board." The late T. Lawrie. (Read by officer of the Board.) Engineers' Club, Albert Sq, Manchester, 6.15 p.m.

WEDNESDAY, 4 JAN.

I.E.E. (Tees-side). "Design—Features of Semi-Outdoor Power Station at Ince." F. H. S. Brown. Cleveland Inst., Middlesbrough, 6.30 p.m.

I.E.E. (S.W. Scotland). "Automatic Circuit Reclosers." G. F. Peirson, A. H. Pollard and N. Care, 39 Elmbank Cres, Glasgow, 7 p.m.

I.E.E. (Southern). "Receiving Aerials for British TV." F. R. W. Strafford. College of Technology extension, Portsmouth, 6.30 p.m.

BRITISH INSTN. OF RADIO ENGRS. (Merseyside). "Electronic Instrumentation for Nuclear Power." R. J. Cox. Chamber of Commerce, 1 Old Hall St, Liverpool, 7 p.m.

INST. OF FUEL (London). "Coal Research Problems and their Industrial Implications." R. L. Brown. Instn. of Civil Engrs., Great George St, S.W.1, 5.30 p.m.

I.E.S. (Newcastle). "Airport Lighting." H. M. Ferguson. King's College, College Rd, 6.15 p.m.

I.E.S. (Swansea). "X-Rays in Medicine and Industry." K. Rawlings. Elect. Offices, The Kingsway, 6.30 p.m.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Ethox. 743,215. Class 9. Switchboards; 744,391. Class 11. Heating and lighting installations. J. R. Ferguson, Tameside Works, Park Rd, Dukinfield, Chester.

H.M.V. 744,861. Class 9. Dry batteries. Gramophone Co., Ltd., Blyth Rd, Hayes, Middx.

Oryx. 745,223. Class 9. Soldering irons. Oryx Electrical Laboratories Ltd., 45 West St, Brighton 1.

Stenocord. 745,518. Class 9. Sound recording and reproducing apparatus, etc. Hartley Electromotives Ltd., 37 Thurloe St, S.W.7.

Siestart. 745,352. Class 11. Light fittings, etc. Siemens Electric Lamps and Supplies Ltd., Caxton Hse, Tothill St, S.W.1.

Blackley Tape. Adhesive tape and insulating tape. Connollys (Blackley) Ltd., Blackley Vale Mills, Blackley, Manchester 9.

Centronic. 733,614. Class 9. Geiger counter and cathode ray tubes. Twentieth Century Electronics Ltd., "Centronico" Works, King Henry's Drive, New Addington, Croydon, Surrey.

Dryad. 746,313. Class 7. Hair drying machines. Bylock Electric Ltd., 109 South St, Enfield, Middx.

Petter. 746,100. Class 9. Switchboards and switches. Petters Ltd., Causeway Works, Staines, Middx.

Memglo. 745,000. Class 11. Heating apparatus. Midland Electric Mfg. Co., Ltd., M.E.M. Works, Reddings Lane, Tyseley, Birmingham 11.

Aylon. 745,744. Class 11. Installations for lighting, lamps and fittings. Stella Lamp Co., Ltd., 37/39 Oxford St, W.1.

Epicol. 745,778 and **Epidec.** 745,780. Class 17. Insulating varnishes. Bitulac Ltd., Collingwood Bldgs, Collingwood St, Newcastle-on-Tyne.

Rotalite. 737,936. Class 7. Generators and ignition devices. Joseph Lucas Ltd., Gt. King St, Birmingham 19.

Pyetronic. 741,068. Class 9. Radar, echo-sounding, nautical apparatus, etc. Pye Ltd., Radio Works, Cambridge.

Hewittic Rectifiers FOR STEELWORKS

The illustration shows two 900 kW Hewittic Rectifiers providing an output of 3600 amps for operating rolling mill auxiliaries in a Scottish steelworks.
There are over 1,500,000 kW of Hewittic Rectifiers in world wide service in capacities up to 30,000 kW.

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HACKBRIDGE AND HEWITTIC ELECTRIC Co LTD

OVERSEAS REPRESENTATIVES: ARGENTINA: H. A. Roberts & Cia., S.R.L., Buenos Aires. **AUSTRALIA:** Hackbridge and Hewittic Electric Co. Ltd., Sydney. **SOUTH AUSTRALIA:** Parsons & Robertson Ltd., Adelaide. **BELGIUM & LUXEMBOURG:** M. Dorfman, 5, Avenue des Phalenes, Brussels. **BRAZIL:** Oscar G. Mors, Caixa Postal 1280, Sao Paulo. **CANADA:** Hackbridge and Hewittic Electric Co. of Canada Ltd., Montreal; The Northern Electric Co. Ltd., Montreal, etc. **CEYLON:** Envee Ess Ltd., Colombo. **CHILE:** Ingenieria Electrica S.A.C., Santiago. **EAST AFRICA:** Gerald Hoe (Lighting) Ltd., Private Bag, Nairobi. **EGYPT:** Giacomo Cohenca Fils, S.A.E., Cairo. **FINLAND:** Sähkö-ja Koneliike O.Y. Hermes, Esplanaadikatu 37, Helsinki. **HOLLAND:** J. Kater E. I., Ouderkerk a.d. Amstel, Amsteldijk Noord 103. **INDIA:** Steam & Mining Equipment (India) Ltd., Calcutta; Easun Engineering Co. Ltd., Madras, 1. **IRAQ:** J. P. Bahoshy Bros., Baghdad. **MALAYA, SINGAPORE & BORNEO:** Harper, Gilfillen & Co. Ltd., Kuala Lumpur. **NEW ZEALAND:** Richardson, McCabe & Co. Ltd., Wellington, etc. **PAKISTAN:** James Finlay & Co. Ltd., Karachi. **SOUTH AFRICA:** Fraser & Chalmers (S.A.) (Pty.) Ltd., Johannesburg. **RHODESIA:** Fraser & Chalmers (S.A.) (Pty.) Ltd., Salisbury, etc. **THAILAND:** Vichien Phanich Co. Ltd., Bangkok. **TRINIDAD & TOBAGO:** Thomas Peake & Co., Port of Spain. **TURKEY:** Dr. H. Salim Oker, 43, Posta Caddesi, Ankara. **URUGUAY:** H. A. Roberts & Cia., S.A.U., Montevideo. **U.S.A.:** Hackbridge and Hewittic Electric Co. Ltd., P.O. Box 234, Pittsburgh 30, Pennsylvania; Electro Machinery Corporation, 50, Broad Street, New York, 4.

Send for Publications R190 R222

R31

Weston Moving Coil Relays

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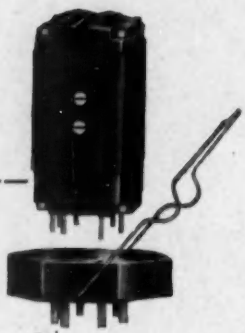
The simplicity and reliability of relay control has led to the ever increasing use of WESTON MOVING COIL RELAYS. Let us have a note of your relay problems and we will be pleased to advise on the most suitable model for any set of conditions. Enquiries should be accompanied by full particulars of both control and local circuits.



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MODEL S54. A relay of extreme sensitivity with wide applications in Laboratory and Industrial Control. The high torque developed by the moving system ensures positive contact pressure.

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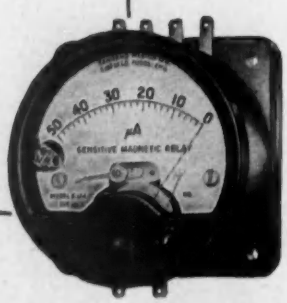

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SW 2

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

ABERDEENSHIRE TRANSMISSION DEVELOPMENT 132 kV ISOLATORS, 33 kV SWITCHGEAR, NEUTRAL EARTHING RESISTANCES AND ANCILLARY EQUIPMENT

TENDERS are invited for the supply and erection of the above equipment for Persley Substation, Aberdeenshire. Tender Documents may be obtained on application with a cheque for £2. 2s. (returnable), to the Engineers, Messrs Merz and McLellan, 72a George St, Edinburgh, 2. The Board do not bind themselves to accept the lowest or any Tender.

H. W. Simpson,
16 Rothesay Ter, Secretary.
Edinburgh 3. (W 266)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

ELECTRICAL INSPECTOR OF WORKS (TEMPORARY)

required by the Sierra Leone Government, Electricity Department for one tour of 18 to 24 months in the first instance. Salary scale (including expatriation pay) £859 rising to £1,266 a year. Commencing salary according to age. Gratuity at the rate of £100/£150 a year. Outfit allowance £60. Free passages for officer and wife; also for two children or grant up to £150 annually for their maintenance in U.K. Liberal leave on full salary. Candidates must have served an apprenticeship with a large Electrical Undertaking and have subsequent practical experience in responsible position in the erection and maintenance of L.T. and H.T. overhead distribution systems up to 11 kV and in laying and jointing underground cables up to 11 kV. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/30682/EE. (W 274)

KENT COUNTY COUNCIL

APPLICATIONS are invited for:
(1) SENIOR ELECTRICAL ENGINEER. Salary £750/£900. Applicants should be Corporate Members of the Institution of Electrical Engineers and have experience in the electrical equipment of buildings.
(2) ELECTRICAL ENGINEER. Salary £650/£775. Applicants should be Graduate Members of the above Institution and have similar experience.
Application forms from County Architect, Springfield, Maidstone. Closing date 12 Jan., 1956. (W 273)

FEDERATION OF NIGERIA

A VACANCY exists for an ELECTRICAL ENGINEER (Meteorological Service) in the Federation of Nigeria (BCD 57/14/04).

Duties include determination of types of radio and radar meteorological equipment to be installed, supervision of maintenance and modification and possible operation of such equipment and work in connection with meteorological signals traffic.

Candidates should hold a University degree in electrical engineering or should have passed such examination as will exempt them from Parts A and B of the examination for A.M.I.E.E. and must have special experience of radar and should preferably have experience of meteorological radio and radar aids. Exceptionally, candidates may be considered with lesser qualification if they have very good theoretical electrical knowledge and have considerable experience in meteorological radio and radar aids.

Appointment is either pensionable on probation in the salary range £1,086/£1,680 per annum or on contract in the salary range £1,290/£1,956 per annum. For candidates without full professional qualifications pensionable salary £876/£1,680 per annum, contract salary £1,080/£1,956 per annum. A gratuity of £37. 10s. for every three months' satisfactory service, payable on completion of a contract appointment. Government quarters are provided if available, at a rental of 8½% basic salary with a maximum of £150 per annum. Free first class passages for the officer and his wife. Assisted passages for children up to a cost of two adult fares and a conditional grant of £75 per annum for a maximum of two children maintained in the United Kingdom. Leave is granted at the rate of seven days for each month of resident service in a tour of 18 to 24 months.

Further details of application, in writing to the Director of Recruitment, Colonial Office Sanctuary Buildings, Great Smith St, S.W.1, giving brief particulars of age, experience and qualifications and quoting the reference number BCD 57/14/04. (W 261)

CENTRAL ELECTRICITY AUTHORITY
South Wales Division

Vacancy No. 140/55

APPLICATIONS are invited for superannuable N.J.B. appointment of ENGINEERING DRAUGHTSMAN (Mechanical) in the Drawing Office, Construction Department, Divisional Headquarters.

Salary: Schedule D, Grade 6, £510/£630 per annum.

Candidates should be suitably trained and qualified. Experience in one or more classes of plant or equipment usually installed in Power Station desirable.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, to be returned by 7 Jan., 1956. (W 283)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEERS (PLANNING)
(TWO VACANCIES)

ALDERSHOT District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class F, Grade 10 (£635/£680 per annum). N.J.B. Conditions of Service.

The successful candidates will be required to assist the Planning Engineer in the preparation of schemes and estimates for extensions and/or reinforcements to overhead and underground H.V. and L.V. networks. Applicants should have had experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground systems, substation plant and distribution equipment. The possession of suitable technical qualifications will be an advantage and the appointment will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed, not later than 13 Jan., 1956.

ASSISTANT ENGINEER (GENERAL)

Southampton District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class F, Grade 10 (£635 x £15—£680 per annum). N.J.B. Conditions of Service.

Applicants should have had experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and distribution equipment. The possession of suitable technical qualifications will be an advantage, and the appointment will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him in envelopes suitably endorsed not later than 13 Jan., 1956.

The successful candidates for the above appointments will be required to contribute to the C.E.A. and Area Boards' Superannuation Scheme, if eligible. (W 275)

CENTRAL ELECTRICITY AUTHORITY
South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. appointments:

Vacancy No. 141/55

1. STATION SHIFT CONTROL ENGINEER, Carmarthen Bay Power Station. Salary: K.10, £790 x £20 to £850 per annum.

Vacancy No. 145/55

2. STATION SHIFT CONTROL ENGINEER, Llynfi Power Station, Nr Bridgend. Salary: G.10, £675 x £15 to £720 per annum.

Higher National Certificate and experience in power station control room desirable.

Application forms for both appointments obtainable from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, to be returned by 9 Jan., 1956. (W 293)

LONDON ELECTRICITY BOARD

DEMONSTRATORS (FEMALE)

APPLICATIONS are invited for the above positions in the Hackney/Stoke Newington and Bethnal Green Districts of the Northern Sub-Area and the Dartford/Erith and Woolwich Districts of the South Eastern Sub-Area.

Applicants should be suitably qualified, holding the E.A.W. or other approved certificate including electrical housecraft, and having experience in conducting demonstrations at Service Centres and in general service centre duties. They should also be experienced in advising consumers on the selection and use of domestic appliances, both at the Service Centre and on consumers' premises.

The posts are graded within the National Joint Council agreement (Administrative and Clerical Grades) as Grade 1, i.e. £425/£525 per annum, plus the appropriate London Area Allowance.

Application forms from Personnel Officer, 46/7 New Broad St, London, E.C.2, to be returned duly completed by 3 Jan., 1956. Please quote ref.: PER/V/2078/2112/T. (W 291)

CENTRAL ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

ASSISTANT MECHANICAL MAINTENANCE ENGINEER, NORTH WILFORD POWER STATION, NOTTINGHAM

Vacancy No. 223/55/ET

Applicants should have had a fundamental training in Mechanical Engineering, including Workshops and should preferably have experience in the maintenance of Mechanical Plant as installed in a modern Power Station.

Preference will be given to candidates who are Corporate Members of the appropriate professional Institution or hold qualifications leading to such membership.

Salary will be in accordance with Class K, Grade 8 (£900 x £25—£975 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Jan., 1956.

ASSISTANT ELECTRICAL MAINTENANCE ENGINEER, COVENTRY POWER STATION

Vacancy No. 233/55/ET

Applicants should have received a thorough technical and practical training, with experience in testing protective gear, maintenance of alternators, transformers, switchgear and associated equipment.

Preference will be given to candidates who hold a recognised qualification.

Salary will be in accordance with Class G, Grade 8 (£755 x £15—£800 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Jan., 1956.

SHIFT CONTROL ENGINEER DRAKELOW POWER STATION

Vacancy No. 231/55/ET

Applicants should be in possession of the Higher National Certificate in Electrical and/or Mechanical Engineering, and have had experience in the control and load despatching of large capacity steam generating plant connected to the National Grid System.

Salary will be in accordance with Class J, Grade 10 (£755 x £15—£800 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Jan., 1956.

ASSISTANT SHIFT CHARGE ENGINEER BURTON-UPON-TRENT POWER STATION

Vacancy No. 225/55/ET

Applicants should have had experience in the operation and maintenance of modern steam plant and also some electrical experience.

Salary will be in accordance with Class E, Grade 9 (£635 x £15—£680 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Jan., 1956.

PLANT CONTROL ENGINEERS CASTLE DONINGTON POWER STATION

Vacancy No. 224/55/ET

Experience desirable in control of Boilers and Turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience.

Technical qualifications to Higher National standard desirable.

Salary will be in accordance with Class L, Grade 10 (£840 x £20—£900 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Jan., 1956.

ASSISTANT ENGINEER (INSTRUMENTS) LEICESTER POWER STATION

Vacancy No. 232/55/ET

Applicants should have the Higher National Certificate or equivalent together with sound practical experience in the maintenance of instruments in a large P.F. fired generating station.

Salary will be in accordance with Class H, Grade 10 (£715 x £15—£760 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Jan., 1956.

FOURTH ASSISTANT ENGINEER (SECTION) STAYTHORPE TRANSMISSION SECTION AMENDED VACANCY NOTICE

Vacancy No. 227/55/ET

The Section contains extensive 275 kV and 132 kV equipment and the candidates must have had wide experience in the maintenance and operation of 132 kV lines and

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continued from previous column

substations in a Transmission Section.

Preference will be given to candidates who are Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

Salary will be in accordance with Class AX/DX, Grade 6 (£600/£785 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Jan., 1956.

SHIFT CHARGE ENGINEER AVON POWER STATION, WARWICK

Vacancy No. 203/55/ET

Applicants should be suitably qualified and have had experience in the operation of modern boiler and turbine plant.

Salary will be in accordance with Class E, Grade 7 (£715 x £15—£760 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Jan., 1956.

STATION CONTROL ENGINEER CASTLE DONINGTON POWER STATION

Vacancy No. 235/55/ET

Applications invited from suitably qualified Engineers who have had experience in control and operation of large Turbo-Alternators.

Salary will be in accordance with Class L, Grade 10 (£840 x £20—£900 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Jan., 1956.

SHIFT CONTROL ENGINEER STAYTHORPE POWER STATION

Vacancy No. 237/55/ET

Applicants should have had a sound training and practical experience in a modern Power Station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be an advantage.

Salary will be in accordance with Class K, Grade 10 (£790 x £20—£850 per annum) of the National Joint Board Agreement.

A house will be available for the successful applicant, if required.

Closing date for receipt of applications, 12 Jan., 1956.

These appointments will be pensionable within the terms and provisions of the Central Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Establishments Officer, Central Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy No.

L. F. JEFFREY,
Divisional Controller.

15 Dec., 1955. (W 290)

NORTHAMPTON POLYTECHNIC, LONDON, E.C.1

APPLICATIONS are invited for full-time ASSISTANT LECTURER in the Electrical Engineering Department. Candidates should possess University Degree in Engineering or equivalent qualification and have had practical experience in the Electrical industry. Post offers experience in advanced work with scope for research and development. Salary in accordance with the London Technical Burnham Scale, Grade B, viz.: £525 by £25 to £820 with allowance of £60 for graduates or equivalent and up to £54 for training plus London allowance of £36 (£48 if over 37) plus up to twelve increments of £18 for industrial experience after the age of 21.

Particulars and form of application from Secretary. (W 287)

EASTERN ELECTRICITY BOARD
Essex Sub-Area

THIRD ASSISTANT ENGINEER SOUTHEND DISTRICT

CANDIDATES should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems including substations.

Salary: N.J.B. Class F, Grade 9 (£675/£720).

Apply by letter within 14 days to the District Manager, Eastern Electricity Board, 85 London Rd, Southend-on-Sea, Essex. (W 281)

CITY OF SALISBURY: SOUTHERN RHODESIA

APPLICATIONS are invited for the following fixed establishment post in the Electricity Department of the above Municipality:

ASSISTANT SHIFT CHARGE ENGINEER (salary scale £1,150 x £50—£1,350 per annum). Applicants must have completed a technical education to the standard of Graduate of the Institution of Electrical Engineers or the Institution of Mechanical Engineers, and must have had experience in the operation of steam power station plant, including control room duties (preferably on an interconnected system), and the running-up of steam turbine plant.

The above appointment is subject to Council's Service and Leave Regulations, which will be made available for inspection by selected candidates at the offices of the undersigned. The salary payable will commence at the minimum of the grade rising by annual increments to the maximum salary of the grade (no cost of living or other allowances are payable).

The successful candidate must be able to comply with the regulations of the Southern Rhodesia Immigration Authorities, and will be required to submit a satisfactory medical certificate.

Applicants, who should be not more than 45 years of age, are required to submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received, marital state, age, place of birth and nationality. Copies of not more than three recent testimonials may be included.

Canvassing, directly or indirectly, will be a disqualification.

Applications, suitably endorsed on the cover, must reach the office of the undersigned on or before 14 Jan., 1956. Airmail paper should be used.

DAVIS AND SOPER LTD.,
Agents to the City Council of Salisbury, Southern Rhodesia.

52 and 54 St. Mary Axe,
London, E.C.3.
15 Dec., 1955. (W 289)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Southern Area

THIRD ASSISTANT DISTRICT ENGINEERS (Two) (Berwick District). N.J.B. Grade D9, £595 x £15—£640.

THIRD ASSISTANT DISTRICT ENGINEER (Hawick District). N.J.B. Grade B9, £515 x £15—£560. (Almost certainly C9 from 1.1.56.)

Applicants for these posts should have a sound technical training, preferably to H.N.C. standard, and experience in the operation and maintenance of overhead and underground distribution systems.

GENERAL ASSISTANT ENGINEERS (Construction) (Two) for Area Headquarters, Galashiels. N.J.B. Grade G13, £555 x £15—£600.

Applicants for these posts should have a sound technical training, preferably to H.N.C. standard. Overhead line survey and construction experience desirable.

Applications stating age, qualifications and experience should reach the undersigned by 3 Jan., 1956.

G. H. SANKEY,
Area Manager.

P.O. Box No. 2.
High St, Galashiels. (W 285)

SOUTH OF SCOTLAND ELECTRICITY BOARD

ASSISTANT SHIFT CHARGE ENGINEER PORTOBELLO POWER STATION

SOUTH of Scotland Electricity Board requires an Assistant Shift Charge Engineer at Portobello Power Station. Experience of Turbo-Generators and Water Tube Boilers. Certificated Marine Engineers would be considered. Salary £790/£850. Superannuable.

Apply in writing to the Secretary, South of Scotland Electricity Board, 168 Broomhill Drive, Glasgow, W.1, before 2 Jan., 1956. (W 262)

CENTRAL ELECTRICITY AUTHORITY
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (*a*) and Corporate Membership for post (*b*) an advantage.

(*a*) ASSISTANT ENGINEER (SHIFT) (3·3 kV SWITCHBOARD), BATTERSEA POWER STATION
Vacancy No. 55/1046

Sound engineering training followed by some experience in a modern Power Station. Salary—Class L, Grade 15=£666. 15s. per annum.

(*b*) SHIFT CHARGE ENGINEER BATTERSEA POWER STATION
Vacancy No. 55/1047

Sound engineering training necessary followed by considerable experience in operation and maintenance of modern High Pressure, High Temperature Power Station plant. Salary—Class L, Grade 7= £1,085 per annum.

(*a*) ASSISTANT ENGINEER (MECHANICAL) GROVE ROAD POWER STATION
Vacancy No. 55/1048

Successful candidate will be required to take charge of drawing office work, lifting tackle tests and records, and to assist generally. Salary—Class F, Grade 11= £624. 15s. per annum.

(*a*) ASSISTANT ENGINEER (OPERATION) ST. PANCRAS POWER STATION
Vacancy No. 55/1049

General duties relating to efficiency, plant operation and technical records. Salary—Class E, Grade 12=£540. 15s. per annum.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, Central Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland St, W.1, and be received within 14 days of this advertisement. (W 286)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Lanarkshire Area

APPOINTMENT OF THIRD ASSISTANT DISTRICT ENGINEER, HAMILTON DISTRICT

APPLICATIONS are invited for the appointment of 3rd Assistant District Engineer in the Hamilton District. Applicants should possess the necessary qualifications and should have had a sound engineering training with some subsequent experience in the maintenance and operation of H.V. and L.V. Distribution Systems.

The Salary and Conditions of Service will be in accordance with the National Joint Board Agreement, Schedule A. The present Classification and Grading will be E.9. Salary £635/£680 per annum, which will be subject to the statutory deductions including superannuation.

The successful candidate will require to reside within a reasonable distance of the Hamilton District Offices and to take part in standby duties in accordance with the above Agreement.

Application forms, which may be obtained from the undersigned, should be forwarded to this office within 14 days of the date of this notice.

DUGALD SMITH,
Manager.
137 Almada St,
Hamilton. (W 296)

CENTRAL ELECTRICITY AUTHORITY
South Wales Division

Vacancy No. 139/55

APPLICATIONS invited for superannuable N.J.B. appointment of SHIFT CHARGE ENGINEER at Uskmouth Power Station, near Newport.

Salary: K.7, £975 x £25—£1,050 per annum.

Applicants should have obtained H.N.C. and served a regular apprenticeship. Operating experience in a modern power station essential.

Application forms obtainable from Secretary, Central Electricity Authority, South Wales Division, Twyn-y-Fedwen Rd, Gadalfa, Cardiff, to be returned by 2 Jan., 1956. (W 272)

LONDON ELECTRICITY BOARD
ENGINEERS (OPERATION AND MAINTENANCE)

APPLICATIONS are invited for the posts of Engineer (Operation and Maintenance) in the Finsbury/Shoreditch and City Districts of the Northern Sub-Area.

Applicants should have had a sound technical education and should have had practical experience in all branches of engineering work associated with the organisation of a District distribution department, particularly in regard to mains and substation work on both A.C. and D.C. systems.

The posts are graded under Schedule A of the National Joint Board Agreement as Class F, Grade 9—£708. 15s. per annum rising to £756 per annum, inclusive of London Allowance.

GENERAL ASSISTANT ENGINEER

Applications are invited for the above position in the Finsbury/Shoreditch District of the Northern Sub-Area.

Applicants should have had a sound technical education up to at least National Certificate standard, with practical experience in general mains work, including installation and maintenance of distribution systems, with the preparation and keeping of associated records.

Pending determination as to the grading and salary applicable to the post within the National Joint Board Agreement, the provisional minimum salary will be £500 per annum, inclusive of London Allowance.

Applications forms obtainable from Personnel Officer, 46/7 New Broad St, London, E.C.2, to be returned completed by 31 Dec., 1955. Please state vacancy preferred and quote ref.: PER/V/2087/8/T. (W 194)

MAINTENANCE ENGINEER (TURBINES)

required by the Central Electricity Board, Malaya, for one tour of three years on contract. Salary scale (including expatriation pay and present temporary allowance) (i) single men £1,687 rising to £2,100 a year, (ii) married men without children, £2,051 rising to £2,499, (iii) family men, £2,254 rising to £2,730. Commencing salary according to qualifications and experience. Gratuity £280 a year. Opportunity of terminating appointment after one year's service. Free passages. Liberal leave on full salary. Candidates should have served a good works apprenticeship on steam turbine or turbo-alternator manufacture and have had subsequent maintenance experience. They should be capable of supervising the mechanical maintenance of 20 MW Parsons turbo-alternators and associated plant in the Connaught Bridge Power Station and, when necessary, major overhauls in the Board's other thermal Power Stations. Corporate Membership of either the Institution of Mechanical Engineers or the Institution of Electrical Engineers desirable, but candidates not holding such qualifications will be considered for appointment on slightly lower salary scale. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters full qualifications and experience and quote M2A/41267/EE. (W 267)

THE NORTH EASTERN ELECTRICITY BOARD

APPOINTMENT OF SUB-AREA COMMERCIAL OFFICER, TEES SUB-AREA HEADQUARTERS, THORNABY ON TEES

THE Officer appointed will be responsible to the Sub-Area Manager for operation of the Commercial Department.

Applicants, preferably corporate members of the I.E.E. must have had thorough technical training and extensive experience of commercial and development work in the Electricity Supply Industry.

Salary and conditions of service in accordance with N.J.M. and H.E. Agreement. Salary: Scale 3, £1,575/£1,725.

Applications stating age, qualifications and experience, present post and salary, should be marked "Confidential" and be received by the Secretary (Establishments) The North Eastern Electricity Board, Carliol House, Newcastle upon Tyne, within fourteen days of the appearance of this advertisement. (W 276)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. Subject to medical examination. Pension Scheme.

ENGINEERING DRAUGHTSMAN (Electrical) at the Board's Headquarters, Electricity House, Love Lane, Liverpool 3. Salary £510/£630 per annum (N.J.B. Schedule D/6).

Applicants should have reached National Certificate level. Experience in the general design and layout of indoor and outdoor substations up to 33 kV, cable layout and diagrams of connections advantageous.

Application forms obtainable from the Establishments Officer at the above address.

COMMERCIAL ASSISTANT (Technical) in the Board's No. 2 Sub-Area, Warrington District. Salary £635/£680 per annum (N.J.B. G/11).

Applicants should have had engineering training, and preferably possess a Higher National Certificate in Electrical Engineering, or other similar qualification.

Standard application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway House, near Northwich, Cheshire.

ASSISTANT SECTION ENGINEER in the Board's No. 4 Sub-Area, Oswestry District, to be based on Whitchurch. Salary £635/£680 (N.J.B. E/9).

Duties include the erection and maintenance of H.V. and M.V. overhead and underground systems.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, near Wrexham.

Closing date for all posts: 2 Jan., 1956. (W 284)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Shropshire and Hertfordshire Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER (LUDLOW DISTRICT)

Duties involve the construction, maintenance and operation of E.H.V. and L.V. mains and substations and planning of system reinforcements and mains extensions. Salary £595/£640 per annum (N.J.B. Grade D.9).

THIRD ASSISTANT DISTRICT ENGINEER (LEOMINSTER DISTRICT)

Duties involve the construction, maintenance and operation of E.H.V. and L.V. mains and substations and planning of system reinforcements and mains extensions. Technical qualifications desirable. Salary £555/£600 per annum (N.J.B. Grade C.9).

Apply by letter, within fourteen days, stating age, experience, present position and salary to Mr W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury.

A. STEPHENS,
Secretary.
(W 282)

CENTRAL ELECTRICITY AUTHORITY
South Western Division

TECHNICAL STAFF VACANCIES

(*a*) ASSISTANT SHIFT CHARGE ENGINEER—Hayle Power Station. N.J.B. Class "F." Grade 9, £675/£720.

(*b*) FOURTH ASSISTANT ENGINEER, System Operation Department, Bristol, N.J.B. Class AX/EX, Grade 6, £600 x £25—£725/£785. Superannuation.

Applicants for (*a*) should have had sound technical training and practical operating experience in a modern power station.

For (*b*) Good General and technical education is essential. Applicants should be Graduates of the I.E.E. or equivalent. Steam generating station experience an advantage. The successful applicant will be required to carry out switching, costing, and general statistical work on a shift/day rota in the Grid Control Room and Office.

(Previous applicants for (*b*) need not reapply as their applications will be reconsidered.)

Apolications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol, 8, should be completed and returned by 2 Jan., 1956. (W 263)

THE NORTH WESTERN ELECTRICITY BOARD

FOURTH ASSISTANT DISTRICT COMMERCIAL ENGINEER (ASSISTANT SERVICE ENGINEER), WIGAN DISTRICT

APPLICANTS must have had experience of all classes of electrical installation work and be capable of drawing up estimates of materials and labour costs; they should also have experience of the maintenance of domestic appliances. The possession of some qualification in electrical engineering or electrical installation work would be an advantage.

Salary Scale: £595 x £15—£640 per annum. Grade F.11. N.J.B. Conditions.

(*a*) FOURTH ASSISTANT ENGINEER (TESTING);
(*b*) GENERAL ASSISTANT ENGINEERS, SUB-AREA TESTING STATION, WALKDEN

Post (*a*) Applicants should have had a wide experience of testing work in a Class "A" Testing Station and particularly of laboratory and site testing of protective gear and applied high voltage tests. Preference given to applicants who hold the H.N.C. in Electrical Engineering.

Post (*b*) The successful applicants will be required to assist in the general work of the Testing Department, including the testing of polyphase metering equipment, current transformers, voltage transformers and protective gear. Applicants should hold the H.N.C. in Electrical Engineering, but consideration will be given to those holding the O.N.C. and who are progressing towards the H.N.C.

Salary Scales:

Post (*a*)—£715 x £15—£760 per annum. Grade L.13.

Post (*b*)—£475 x £15—£520 per annum. Grade L.19.

N.J.B. Conditions.

Applications for the above posts to the Sub-Area Manager, No. 2 Sub-Area, The North Western Electricity Board, 2 St. George's Rd, Bolton, by 31 Dec., 1955.

N.B.—Persons who applied in response to the previous advertisements of posts (*a*) and (*b*) need not re-apply.

THIRD ASSISTANT ENGINEER, SUB-AREA MAINS ENGINEER'S DEPARTMENT, PRESTON

Applicants should have had a wide experience in the construction, operation and maintenance of large industrial and rural networks, including overhead lines and underground cables at voltages up to 33 kV and in high voltage testing and fault localising. The person appointed will be required to undertake standby duty.

Preference given to applicants who have had experience in the control of 33 kV substations and systems, and who hold the H.N.C. in Electrical Engineering.

Salary Scale: £840 x £20—£900 per annum. Grade L.10. N.J.B. Conditions.

Applications to Sub-Area Manager, No. 4 Sub-Area, The North Western Electricity Board, 40/41 Lune St, Preston, by 31 Dec., 1955.

METER TESTERS, PRESTON AND BLACKPOOL

Rate of pay: 49d. per hour. N.J.I.C. Conditions.

Applications to the District Commercial Engineer, 4a (Preston) District, The North Western Electricity Board, 19 Friargate, Preston, or 4d (South West Fylde) District, Shannon St, Blackpool, as appropriate, by 31 Dec., 1955.

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER, RIBBLESDALE DISTRICT

Applicants should be experienced in the supervision of Service Centres, organisation of exhibitions, demonstrations and displays. The successful candidate will be responsible for Domestic and Commercial development and the supervision of the staff engaged on that work. Experience in a rural area would be an advantage. Ability to develop business is essential and preference will be given to applicants with technical qualifications.

Salary Scale: £715 x £15—£760 per annum. Grade E.7, N.J.B. Conditions.

SENIOR SERVICE CENTRE ASSISTANT (MALE), BLACKBURN DISTRICT

Applicants should be of good address,

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have had a good general education, be experienced in the use of electrical appliances, and possess knowledge of electricity tariffs. Preference will be given to applicants who hold the E.D.A. Salesmanship Certificate and who are prepared to take approved courses of study in Electrical Engineering.

Salary Scale: £585 x £20—£645 per annum. Grade 3. N.J.C. Conditions.

Applications for the above posts to Sub-Area Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, by 31 Dec., 1955.

N.B.—Persons who applied in response to the previous advertisement of this post need not re-apply. (W 295)

A LARGE industrial Company requires an ASSISTANT ENGINEER who has experience in all aspects of industrial coal fired boiler plants and their associated machinery.

A real understanding of modern boiler design and practice is essential.

Candidates should send full particulars of qualifications, age and experience to—Box No. 5079, Electrical Times. (W 269)

BRITISH Engine Boiler and Electrical Insurance Co., Ltd., 24 Fennel St, Manchester 4. The Company has vacancies for ELECTRICAL SURVEYORS in various districts in England and Scotland (Kilmarnock/Ayr). Permanent positions carrying progressive salary scale £600/£850 and non-contributory pension. Candidates age 26 to 30 years with apprenticeship in the manufacture or repair of electrical machinery and preferably with subsequent experience of industrial use of electrical machinery, and who have gained the Higher National Certificate in Electrical Engineering or are Graduates of the Institution of Electrical Engineers, are invited to apply in own handwriting stating age, qualifications and experience. (W 292)

THE ATOMIC WEAPONS RESEARCH ESTABLISHMENT
Aldermaston, Berkshire

requires:

TECHNICIANS

Post A. To assist in the installation, day-to-day operation, maintenance, etc., of high voltage particle accelerators including a 6 M.e.V. Van de Graaff generator.

Post B. For work in a Thermonuclear Physics Group studying possible methods of utilising energy from the fusion of light elements.

Applicants should have served a recognised apprenticeship or have had several years approved training or experience as a Technician in at least one of the following fields:

Particle accelerator operation and maintenance; high voltage engineering; electronics; high vacuum techniques; rotating electrical machinery and associated control gear; gas discharge. Possession of O.N.C. is desirable.

Salary: £608 per annum (linked to age 26)—£748 per annum.

Contributory Superannuation Scheme. Married officers now living outside the Establishment's transport area will be eligible for housing on one of the Authority's estates, alternatively assistance towards legal expenses incurred in house purchase will be available; until housed a lodging allowance may be payable.

Requests for application forms by postcard to Senior Recruitment Officer at the above address, quoting reference number 843/49.

(W264p)

LEVER BROTHERS,
PORT SUNLIGHT, LIMITED

require ENGINEERING ASSISTANTS for work on a power station project. The work involves the design and construction of a power station, complete with oil-fired boiler plant, back-pressure turbines, a large water treatment plant, and an extensive steam distribution system. Applicants should hold a H.N.C. or equivalent and have had experience of work connected with the design and layout of power stations. The position is classed as Supervisory grade of Management. Contributory Pension Scheme. 5-day week, day work. On completion of the project the Company will be recruiting staff for operation and maintenance of the new station, and Engineering Assistants employed on the project will be considered in this connection. Applications giving full details of qualifications and experience should be made in writing and addressed to the Personnel Manager, Lever Brothers, Port Sunlight, Limited, Port Sunlight, Cheshire. (W 294p)

ASSISTANT ENGINEER required for Overhead Line Contracts, Inverness Area. Good salary plus subsistence if applicable. Apply: B. French Limited, Pike Mills, Green St, Kidderminster. (W 220)

CABLE JOINTING. Progressive firm in South has opening for DESIGN AND DEVELOPMENT ENGINEER with experience of modern methods of cable jointing. Write, in confidence, stating age, salary required and experience, to Managing Director —Box No. 5063, Electrical Times. (W 131)

COURTAULDS LIMITED require an ENGINEER for their Engineering Headquarters, Coventry, to work in a specialised section on specification, selection and starting up of new boiler plants: the section is also responsible for investigating, testing and advising on the use of existing boiler plant and associated auxiliary machinery.

A sound basic knowledge of the principles of combustion as applied to modern boiler practice and experience of coal firing on chain-grate stokers are essential. Optimum age 40.

Candidates should write for a detailed form of application to the Director of Personnel, Courtaulds Limited, 16 St. Martins-le-Grand, London, E.C.1, quoting reference number B.31. (W 268)

DRAUGHTSMEN, for eventual promotion to Engineers. Must be experienced in power station electrical layout work in drawing office and on site. Location of work, London. Good salaries are offered. Five-day week. Non-contributory pension scheme. Upper age limit 35.—Box No. 5077 Electrical Times. (W 228)

DRAUGHTSMAN wanted as Assistant to Engineer for preparation of electrical layouts for lighting, heating and power in industrial buildings. Preference would be given to one who has completed N.S. Apply Christy Bros. Limited, Chelmsford, Essex, with full particulars. (W 246)

POWER CABLE PRODUCTION SUPERINTENDENT

required

Age range 35-40

Cable-making experience essential, also some educational training in mechanical and electrical engineering. Experience of production planning methods and practice as related to cables. Excellent prospects.

Write full details to:

PERSONNEL MANAGER,
TELCON WORKS,
Greenwich, S.E.10

(W 260p)

IMPERIAL CHEMICAL INDUSTRIES LIMITED

Wilton Works

ENGINEERING DESIGNERS

The construction of the Company's factory at Wilton on a 2,000 acre site has proceeded continuously since 1946 and now over ten million pounds are spent each year on new works. Staff with experience in design of modern works are required for this development.

The immediate vacancies are for:

ASSISTANT TECHNICAL OFFICERS

MECHANICAL ELECTRICAL
CIVIL STRUCTURAL
INSTRUMENT

The appointments are to permanent staff and the Company is anxious to engage men who have had first rate experience to assist with the long-term plans for further development. Candidates in this category will be invited to interview, without commitment, at the Company's expense.

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Write for application form to:

STAFF MANAGER
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Wilton Works, Middlesbrough
quoting reference ICI/X/276

(W 277p)

DESIGN ENGINEER required for the development of outdoor-type high voltage isolating switches and fuse gear for 11 kV and above. Applicants must have had good Drawing Office training and experience in the design of similar equipment. Write giving particulars of experience, age and salary required to—Box No. 5083, Electrical Times. (W 271)

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The Company invites applications for this Senior Executive appointment from Chartered Electrical or Mechanical Engineers with suitable experience and background. The position, which carries a substantial salary, involves the Management and organisation of a central Engineering Service department concerned with:

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Candidates should write for a detailed form of application to the Director of Personnel, Courtaulds Limited, 16 St. Martins-le-Grand, London, E.C.1, quoting reference number B.32. (W 227p)

SALES ENGINEERS required for preparation of Switchgear and Transformer Tenders, previous experience essential. Minimum qualifications, Higher National Certificate. Applications giving full particulars of age, experience, and qualifications to—Box No. 5085, Electrical Times. (W 278)

SALES ENGINEER required as personal assistant to Sales Director for Motor Control Gear company in N.E. London. Excellent prospects for applicant with good electrical training, personality and some experience. Duties include interviewing customers and preparation of tenders and sales literature. Write, stating age, experience and salary required.—Box No. 5067, Electrical Times. (W 177)

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TRANSFORMER TEST ENGINEER to take charge of Test Department dealing with units up to 15 MVA. Also ASSISTANT TESTER for above Department. Write, giving details of qualifications, experience and approximate salary expected, to Technical Director, Bryce Electric Construction Co., Ltd., Kelvin Works, Hackbridge, Surrey. (W 199)

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Wakefield

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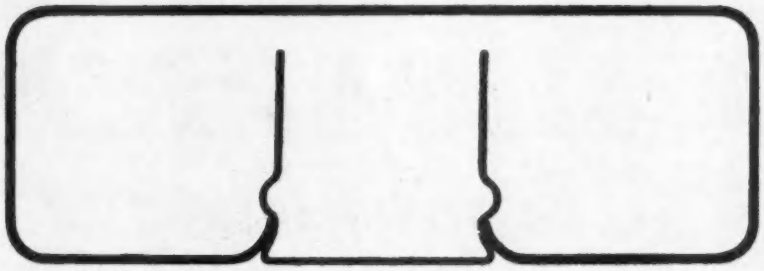

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Covered by Patent Applications Nos. 20825/54 30248/54

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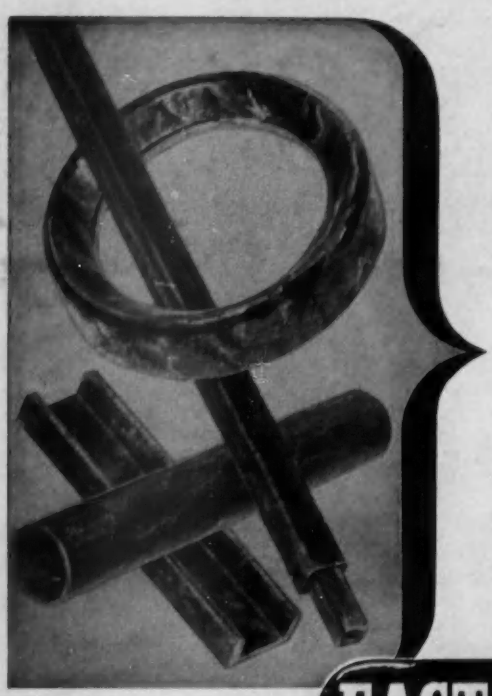

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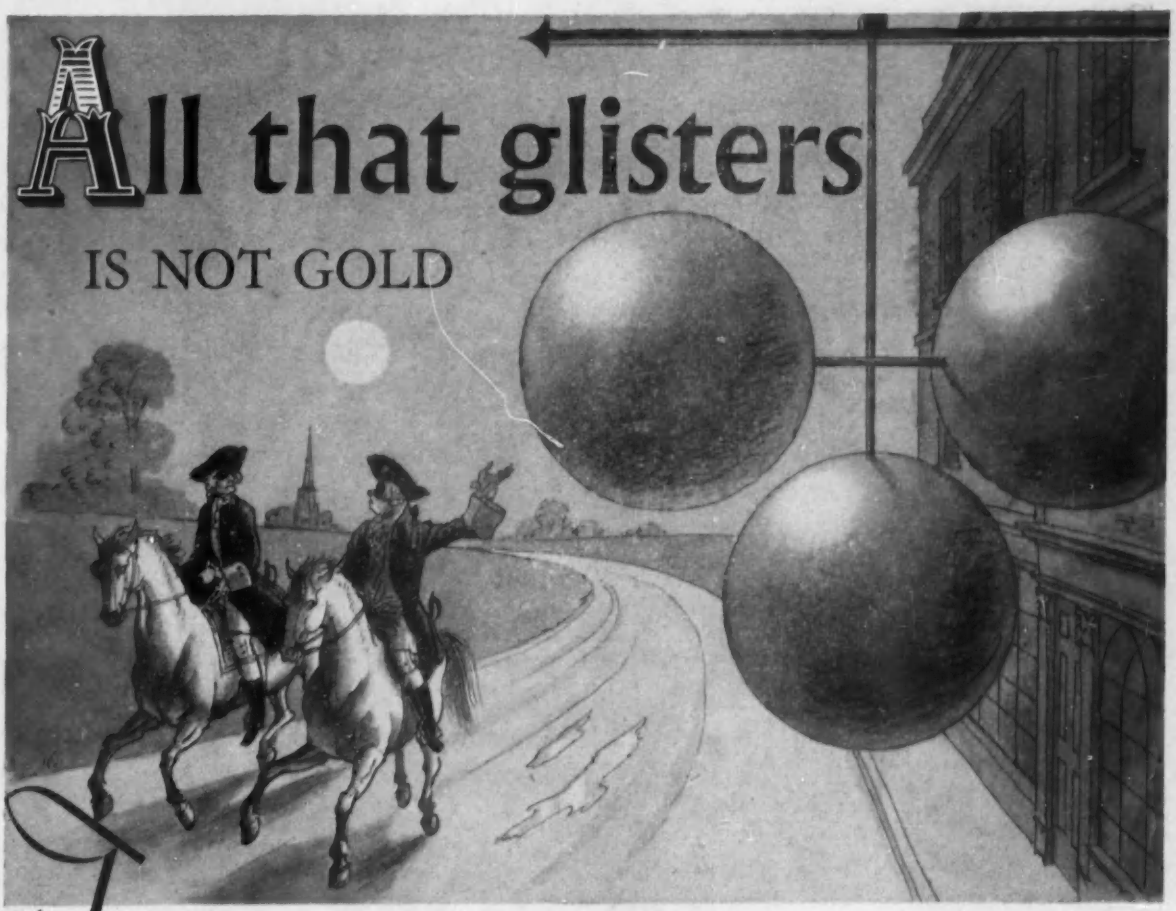

THREE GREAT golden balls glistened in the moonlight. "Zounds!" cried the First Robber —"there's as pretty a sight as ever I did see, all set out werry neat and orderly, and all a-ready for the taking of by two enterprising gents with an eye to business. Do you give me a leg, Skipper, and I'll part 'em from their moorings werry brisklike — afore ye can say Jack Ketch!"

"Tch!" murmured his companion, a man of sharper intellect and wider experience than honest Jeremy — "such simple faith is sadly misplaced, old friend. These globes are neither gold nor other precious metal, being wrought — probably in Birmingham — of brass. Hollow at that —" he added testily, rapping one of them with his cane. It gave out a dull, lack-lustre note.

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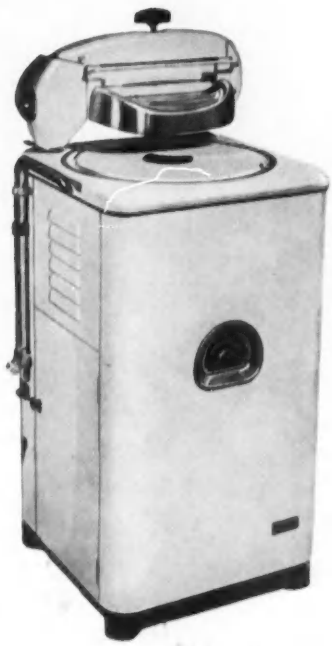

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